Cancel

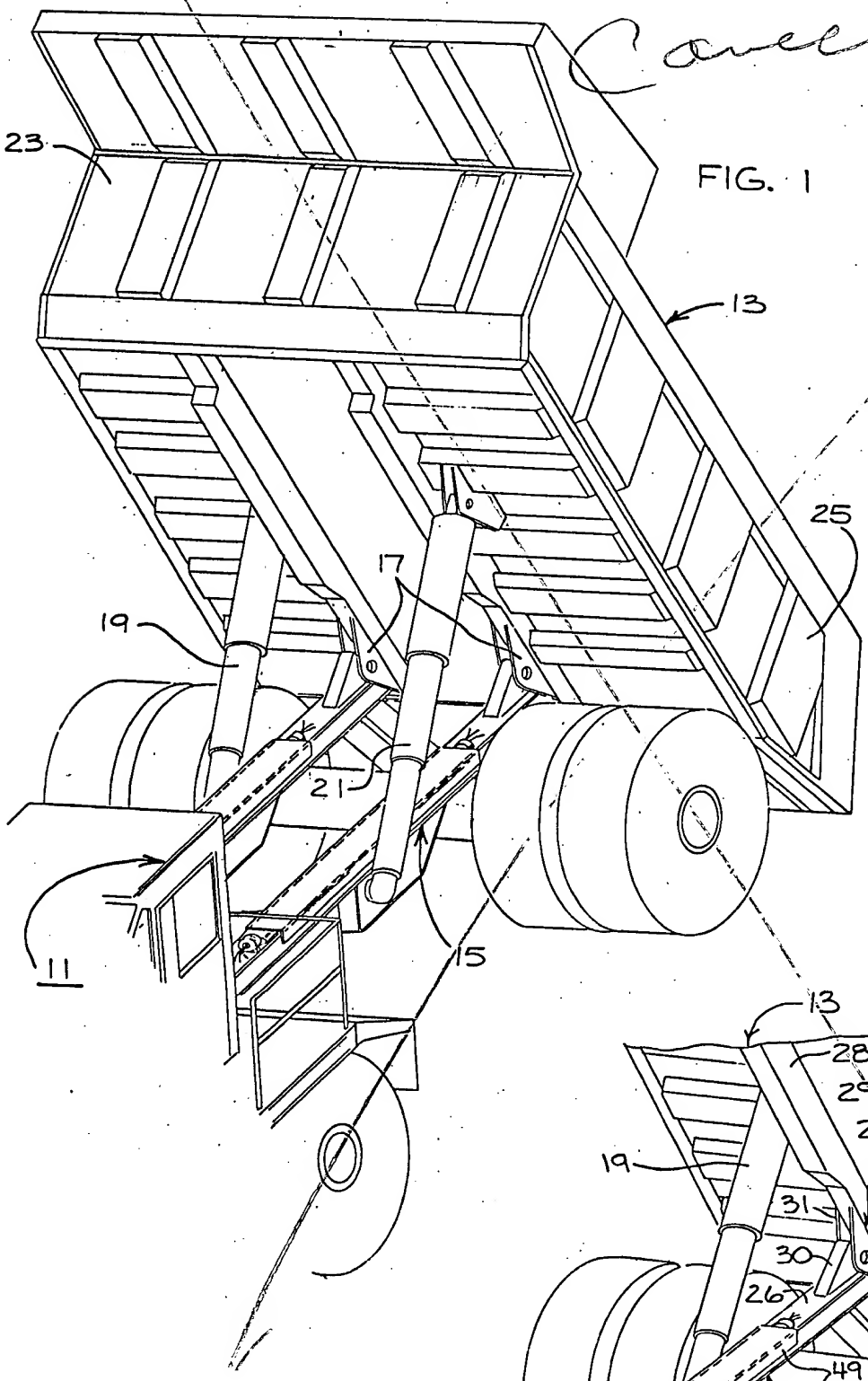


FIG. 1

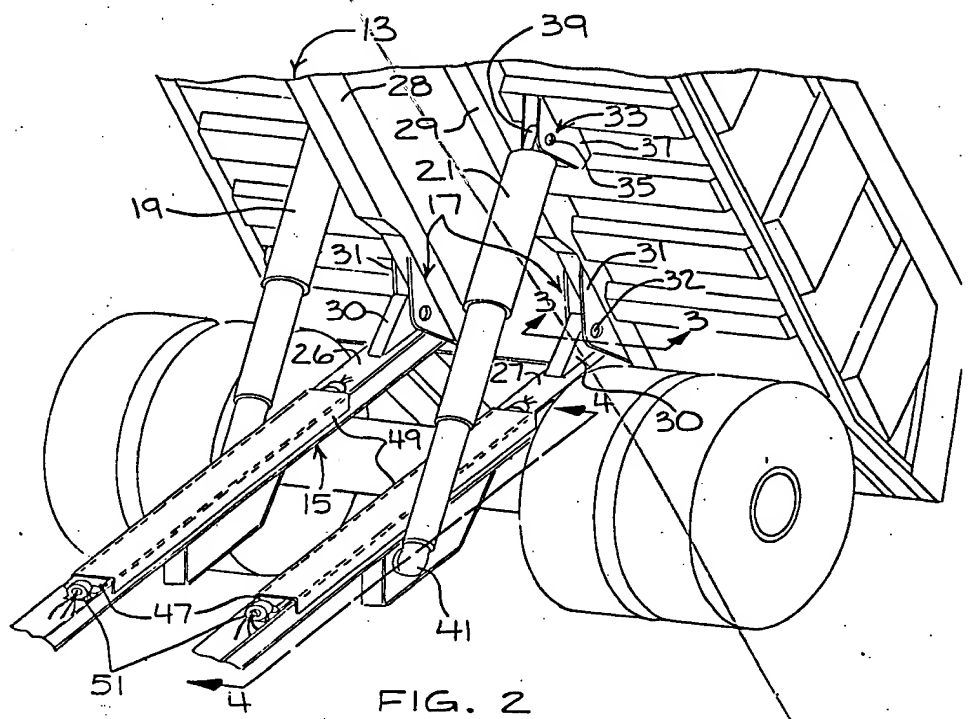


FIG. 2

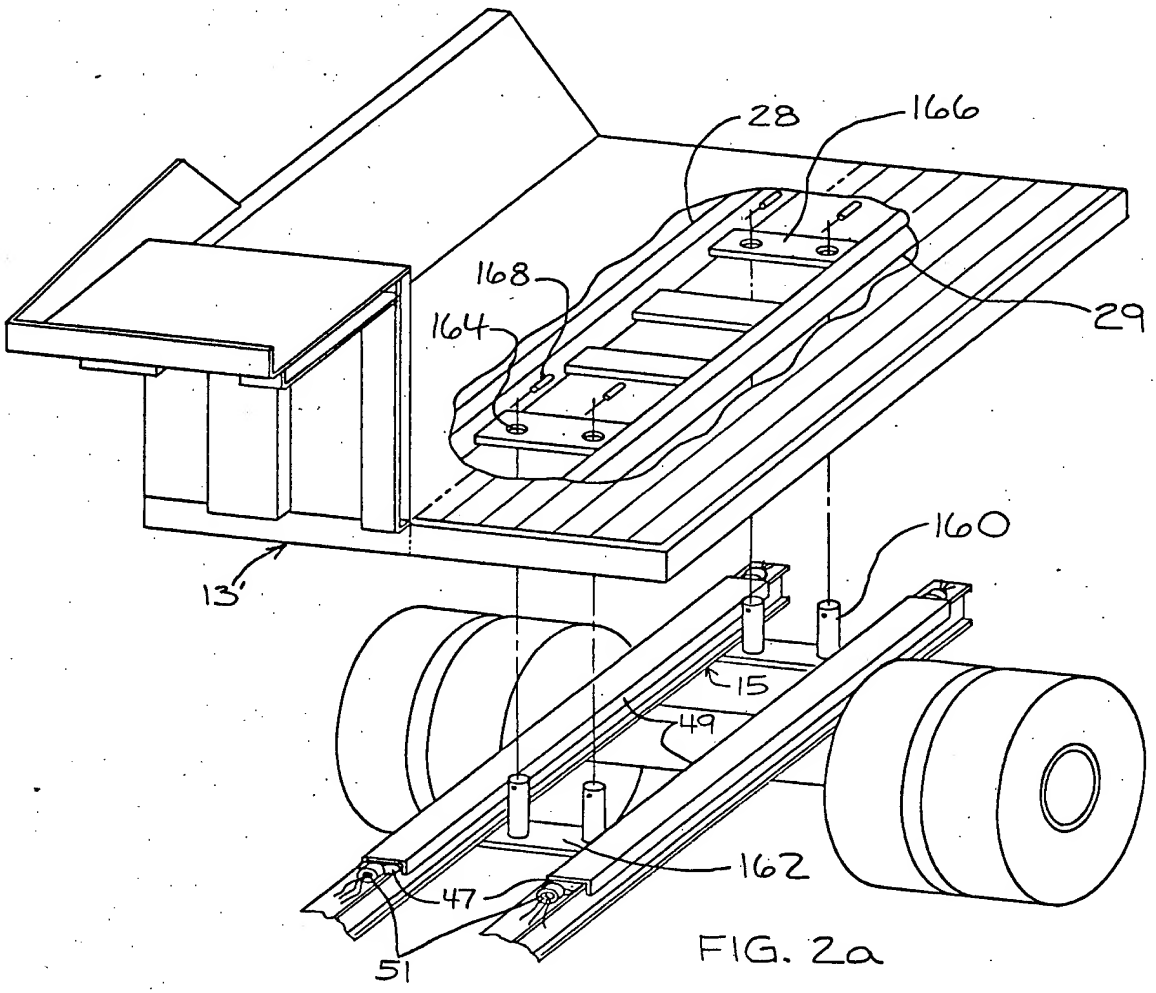


FIG. 2a

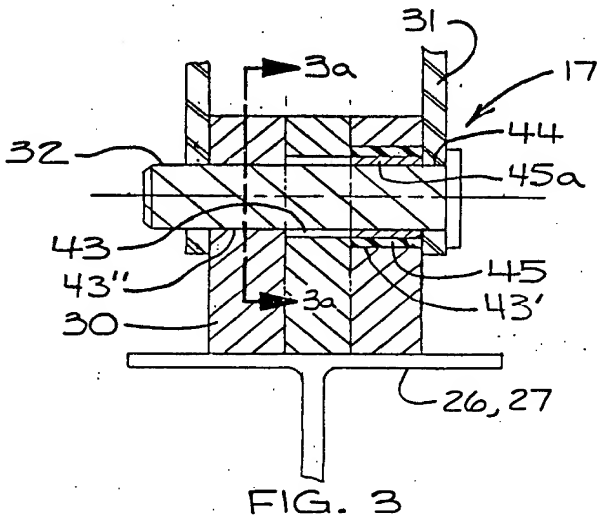


FIG. 3

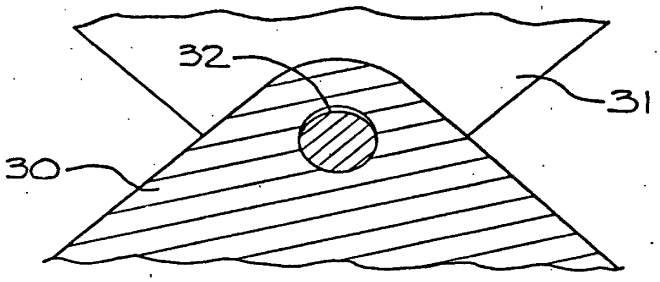


FIG. 3a

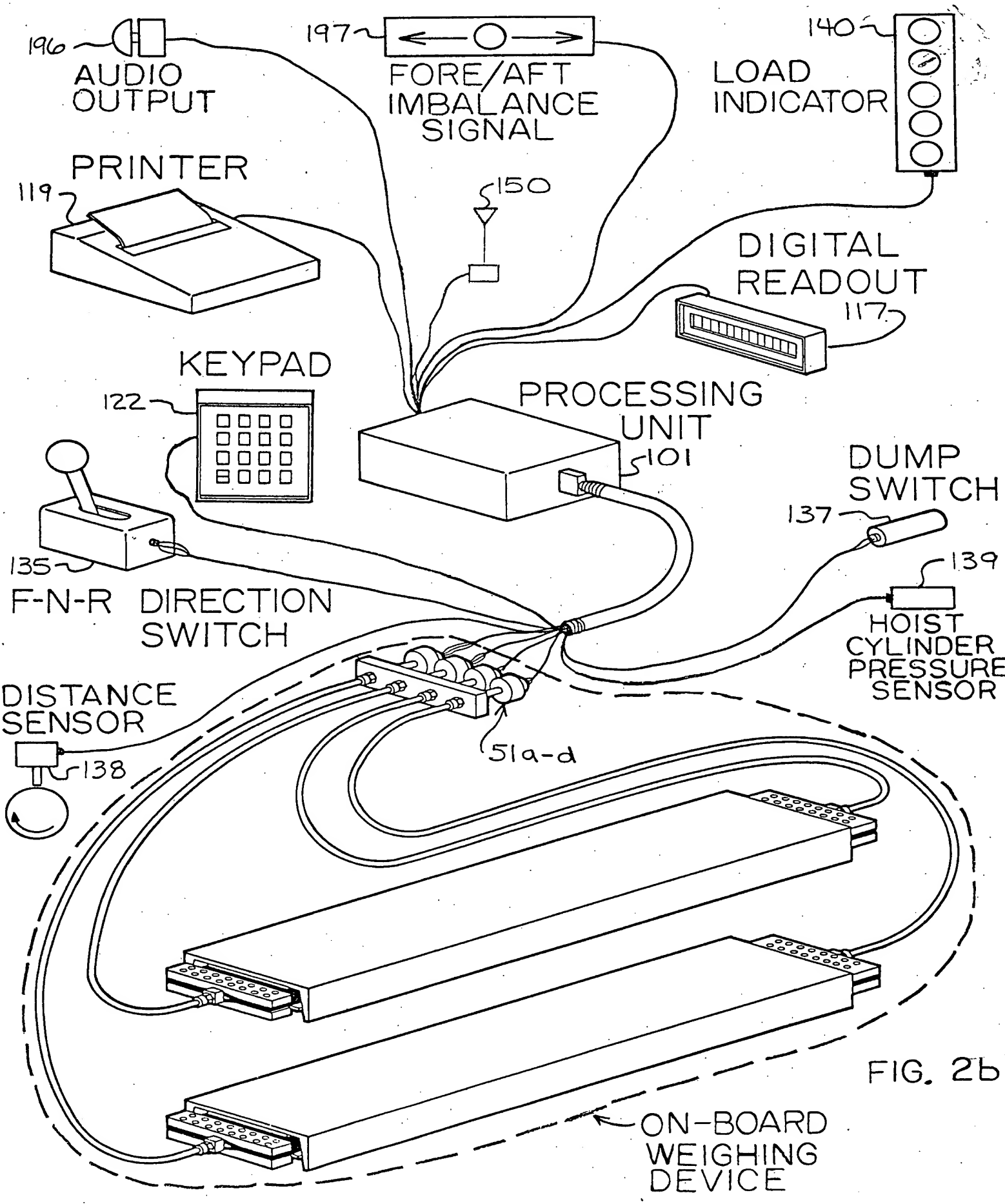

196
AUDIO OUTPUT
197
FORE/AFT IMBALANCE SIGNAL
140
LOAD INDICATOR
PRINTER
119
150
DIGITAL READOUT
117
KEYPAD
122
PROCESSING UNIT
101
DUMP SWITCH
137
135
F-N-R DIRECTION SWITCH
139
HOIST CYLINDER PRESSURE SENSOR
DISTANCE SENSOR
138
51a-d
ON-BOARD WEIGHING DEVICE

FIG. 2b

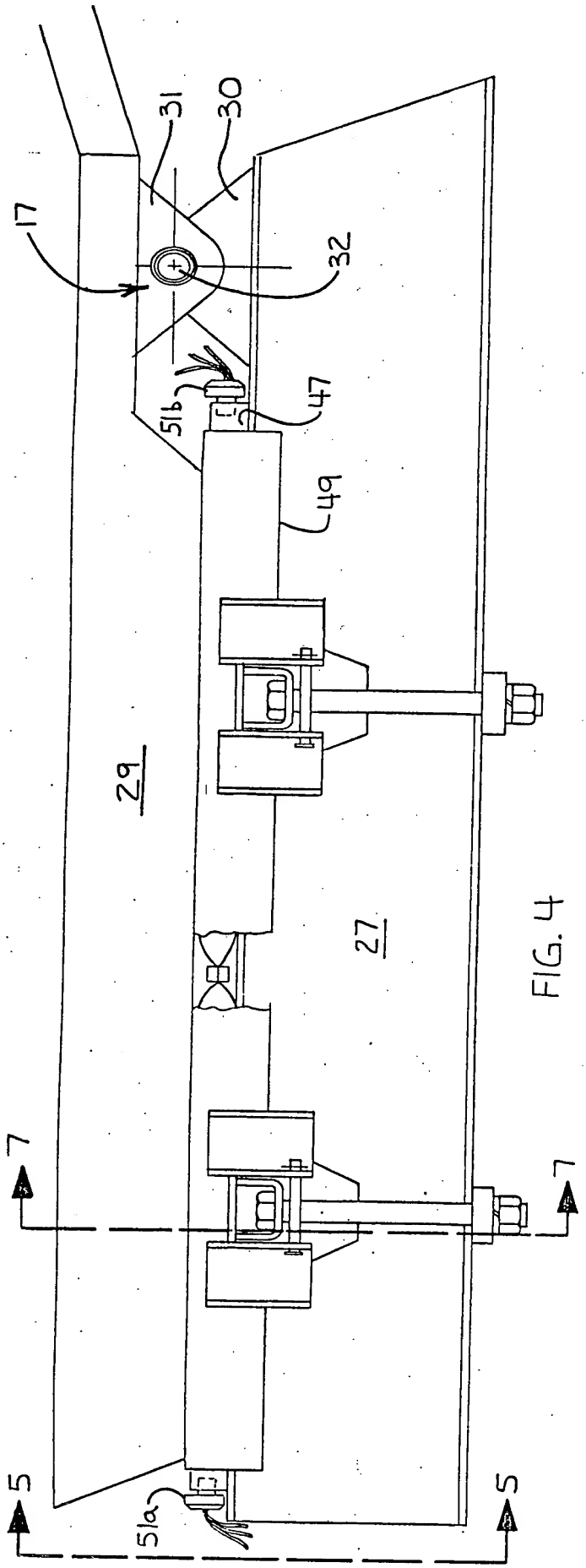


FIG. 4

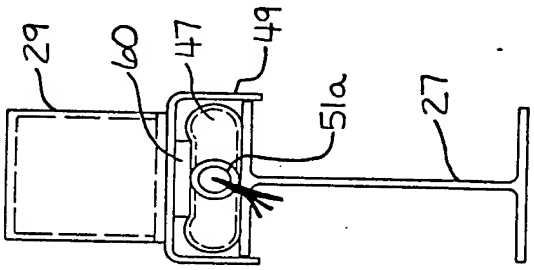


FIG. 6

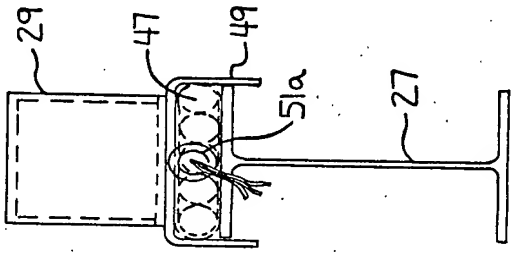


FIG. 5a

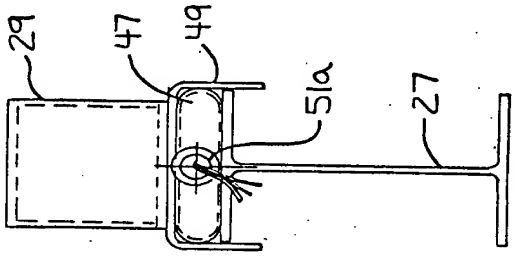


FIG. 5

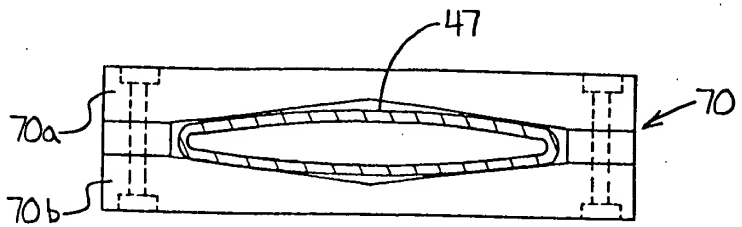


FIG. 9

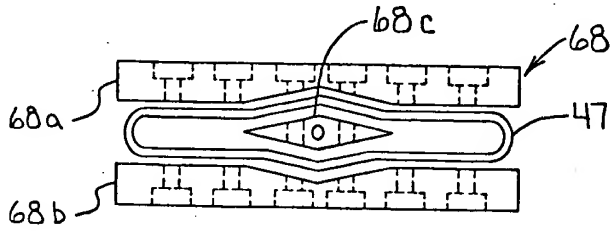


FIG. 8a

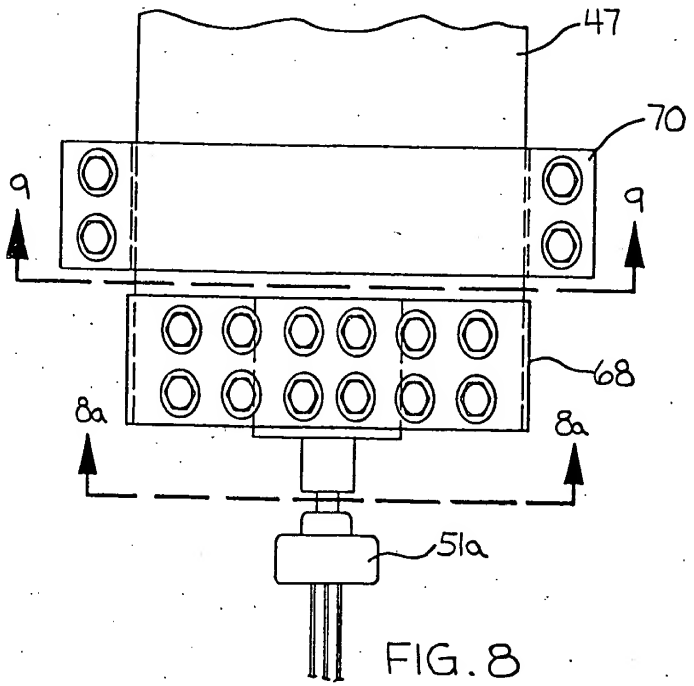


FIG. 8

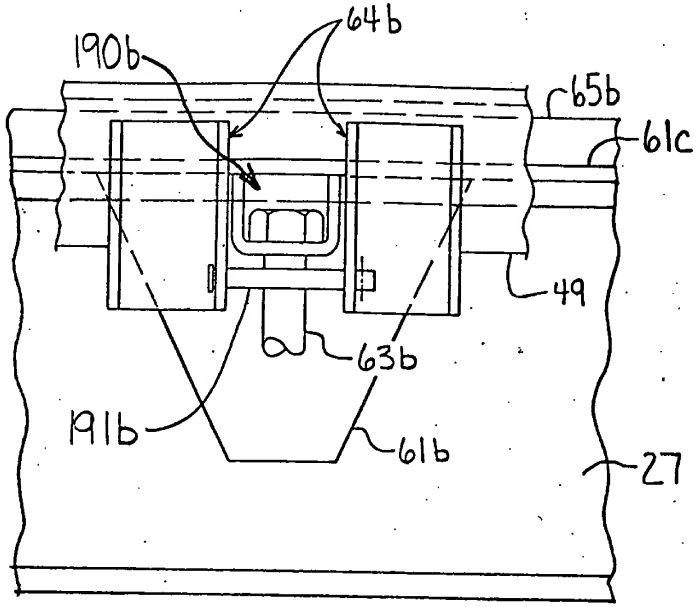


FIG. 7a

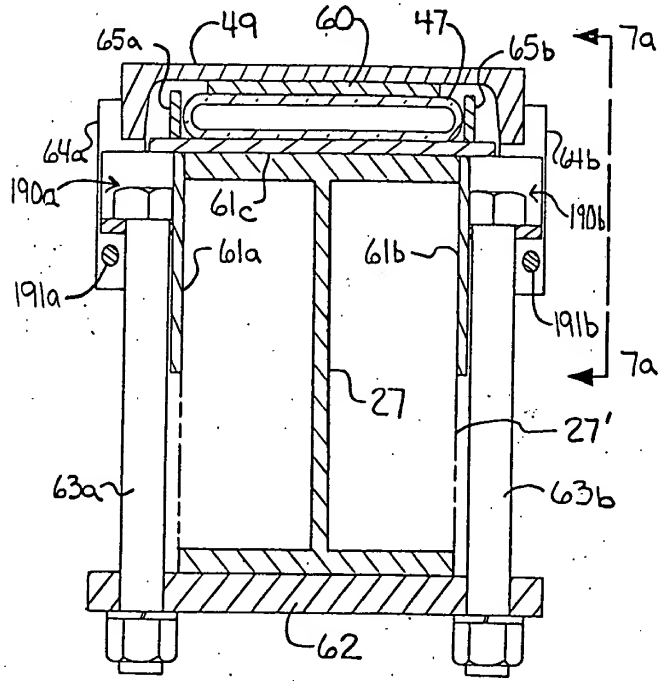


FIG. 7

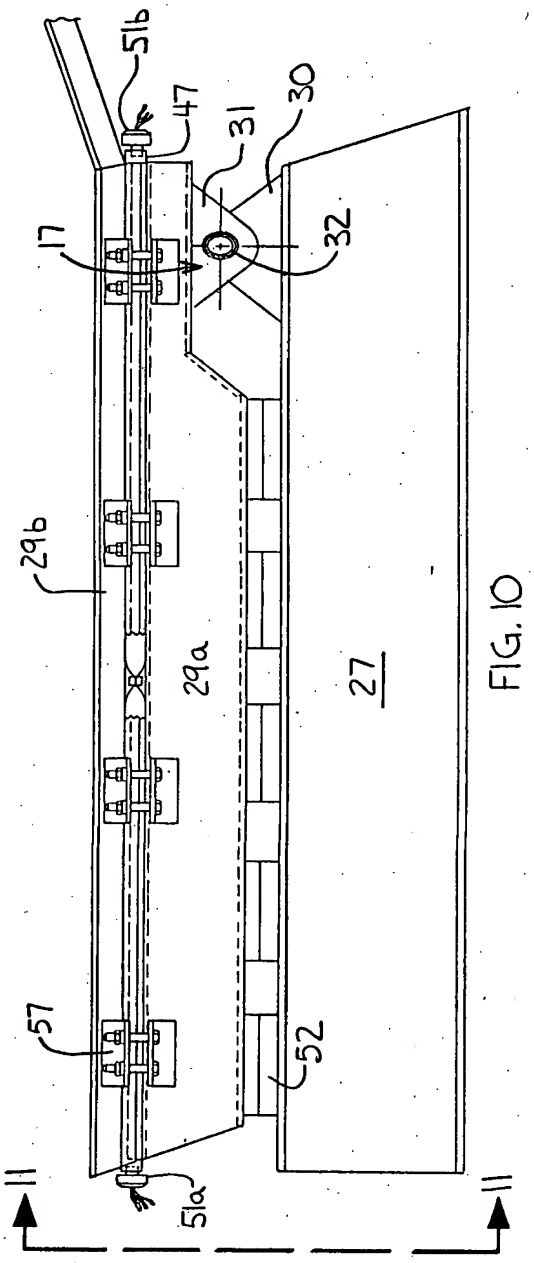


FIG. 10

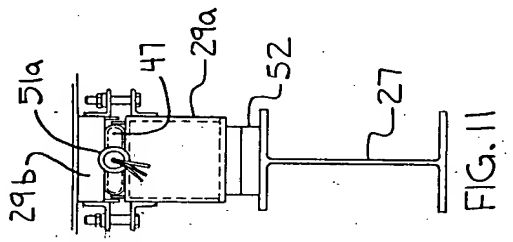


FIG. 11

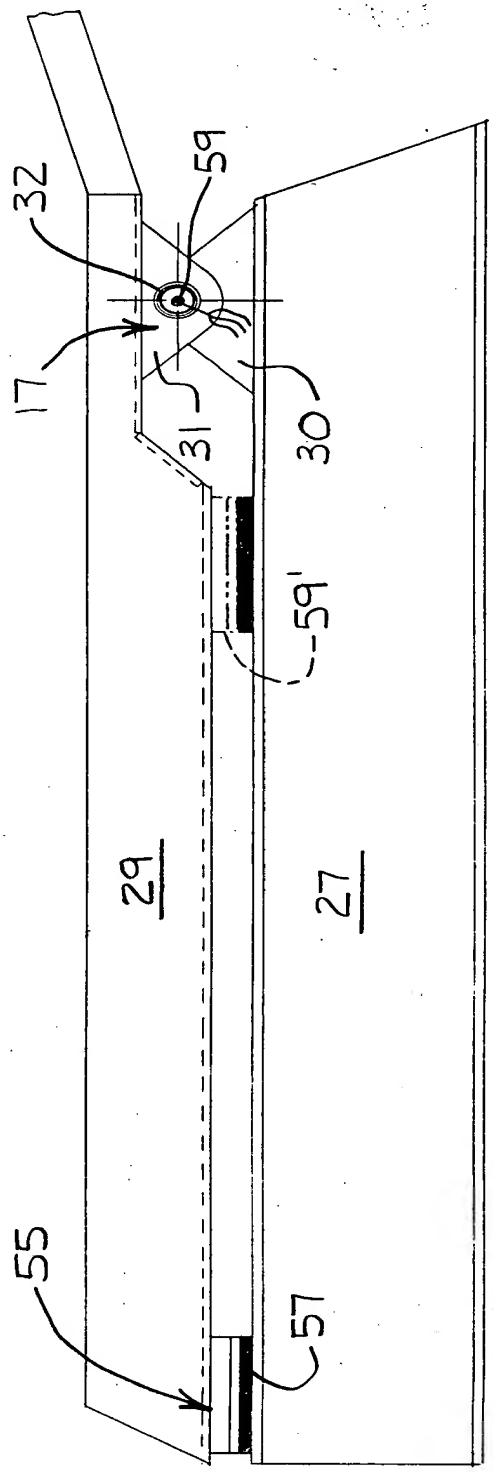


FIG. 12

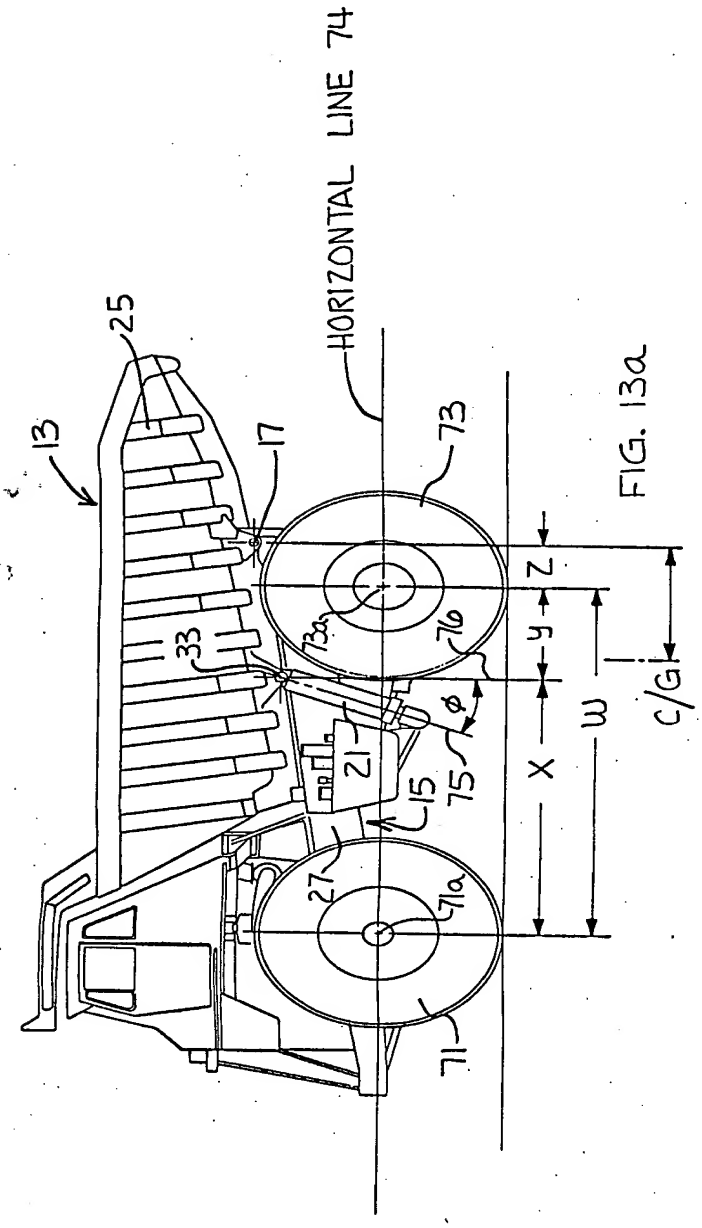


FIG. 13a

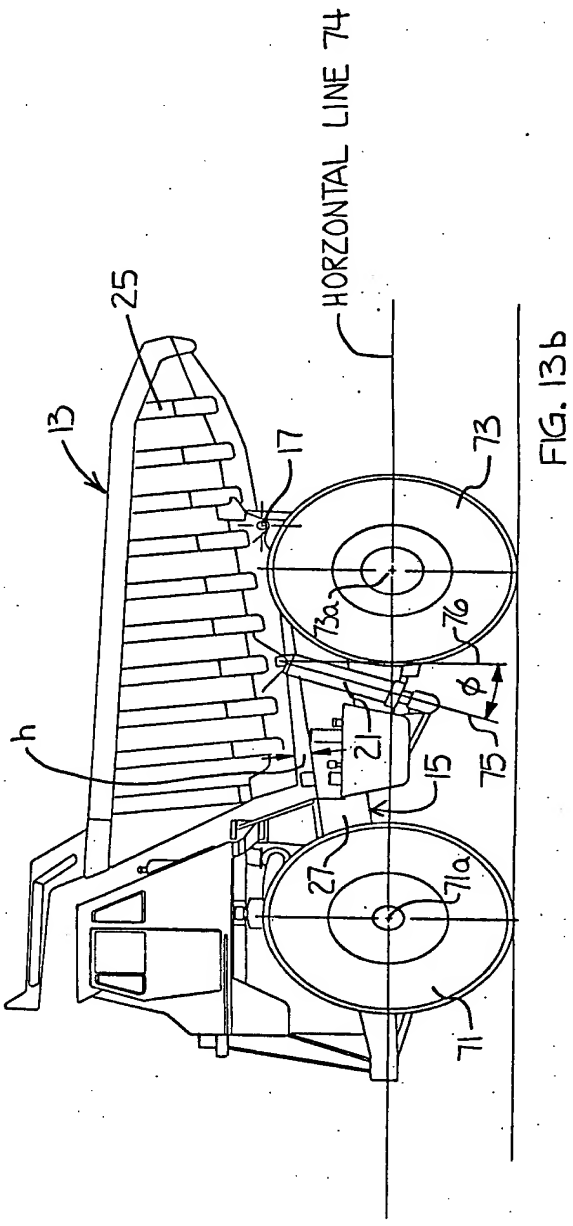


FIG. 13b

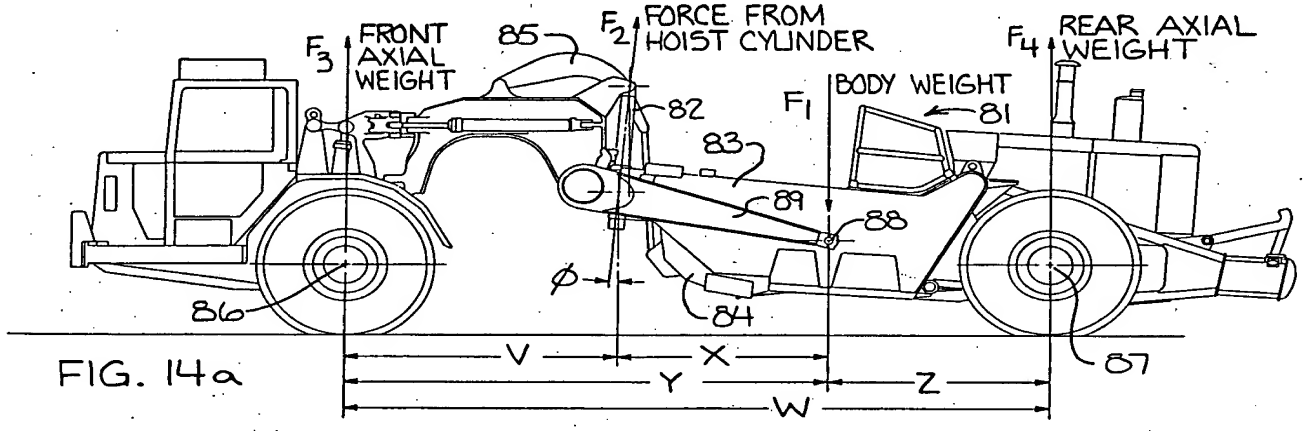


FIG. 14a

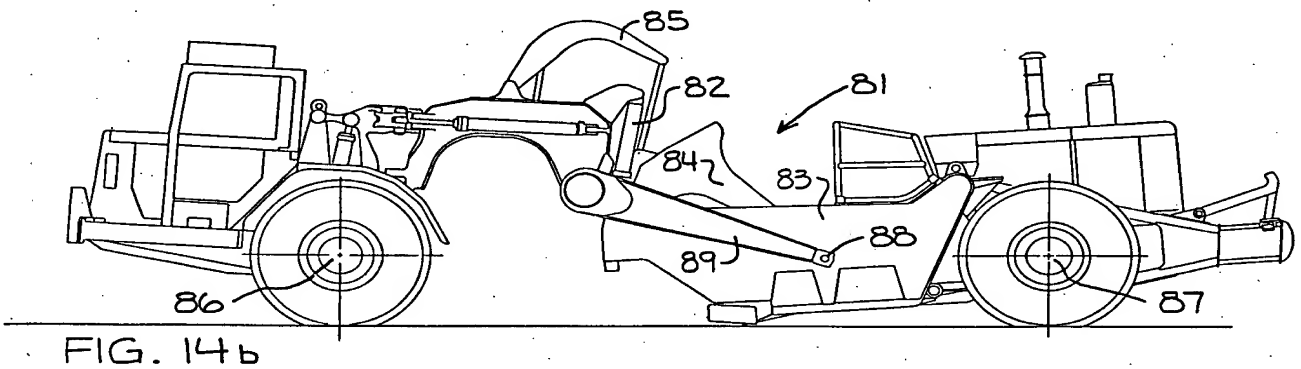


FIG. 14b

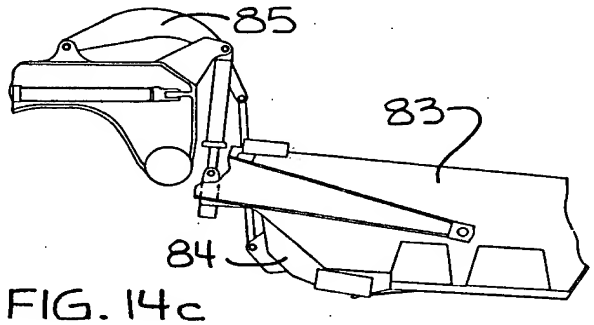


FIG. 14c

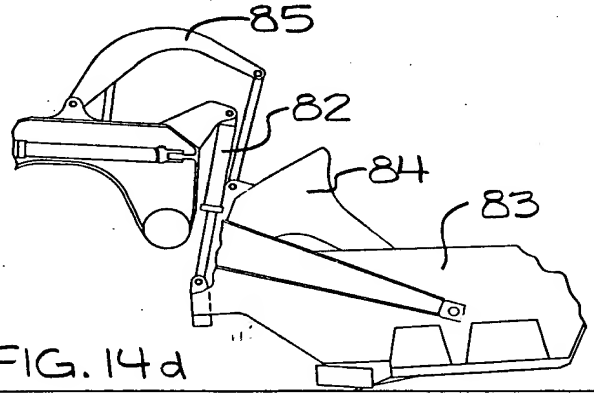


FIG. 14d

FIG. 15a

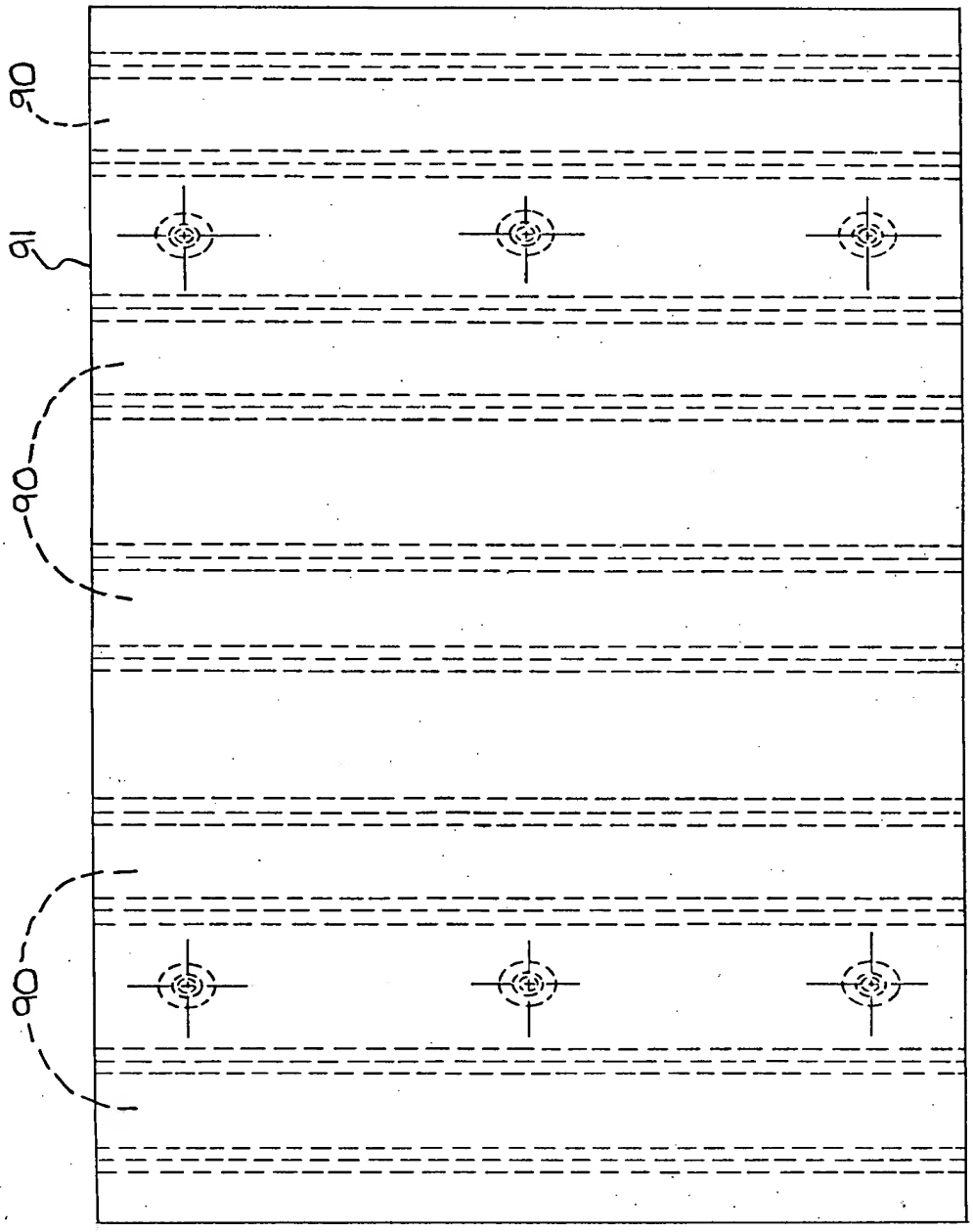
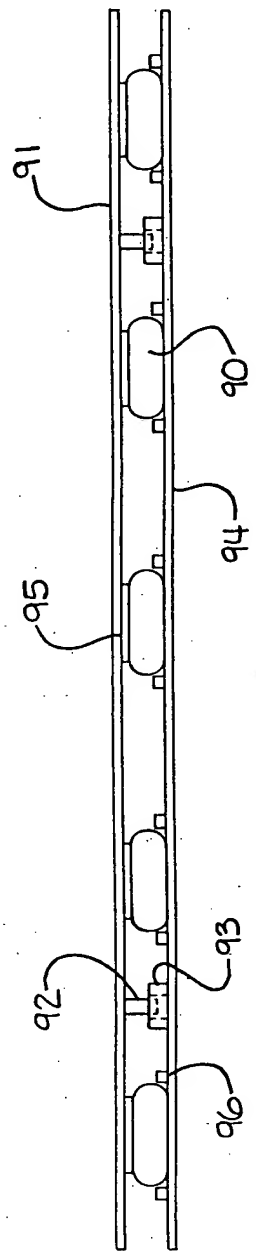


FIG. 15b



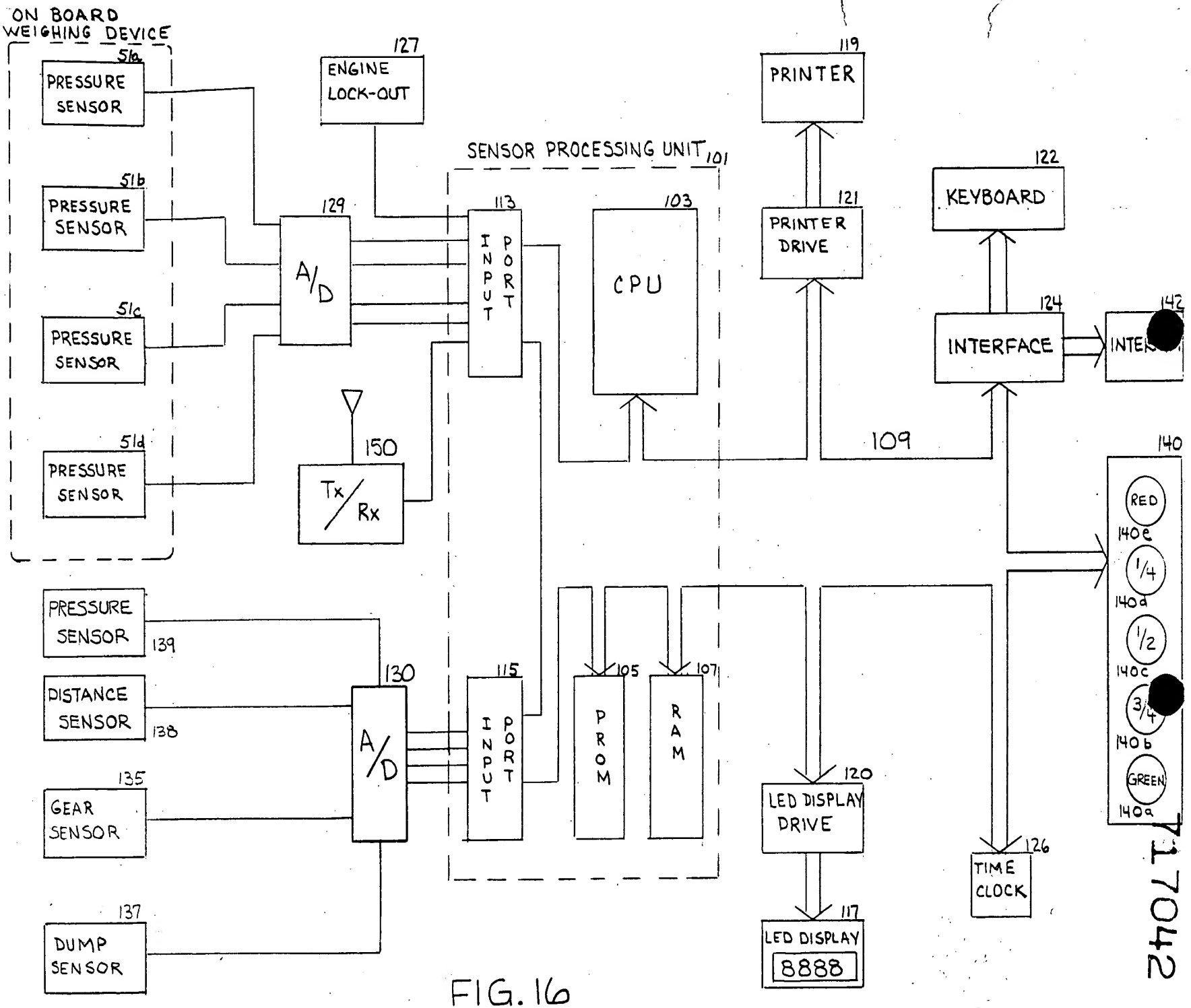


FIG. 16

4,717,042

RAM 107

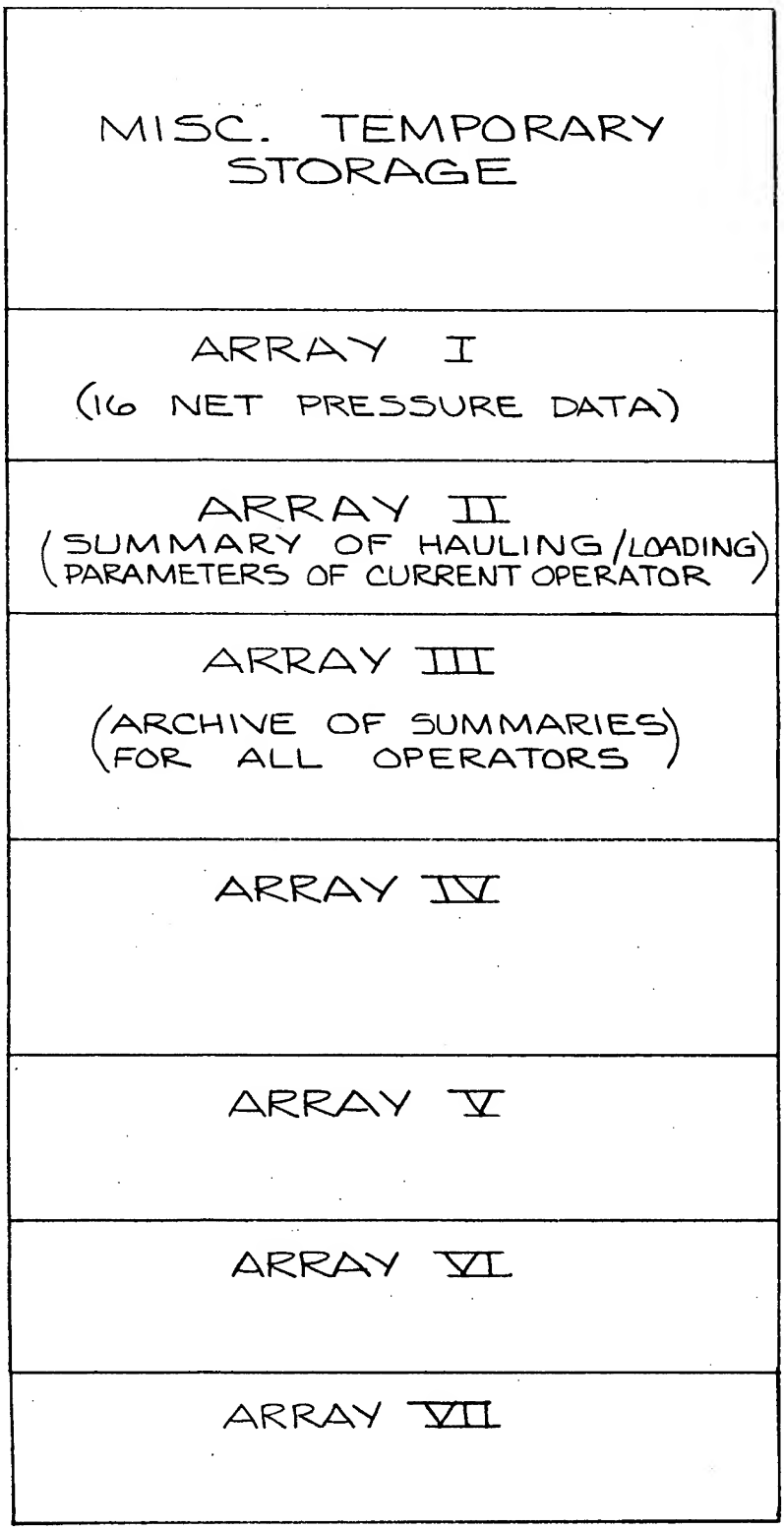


FIG. 16a

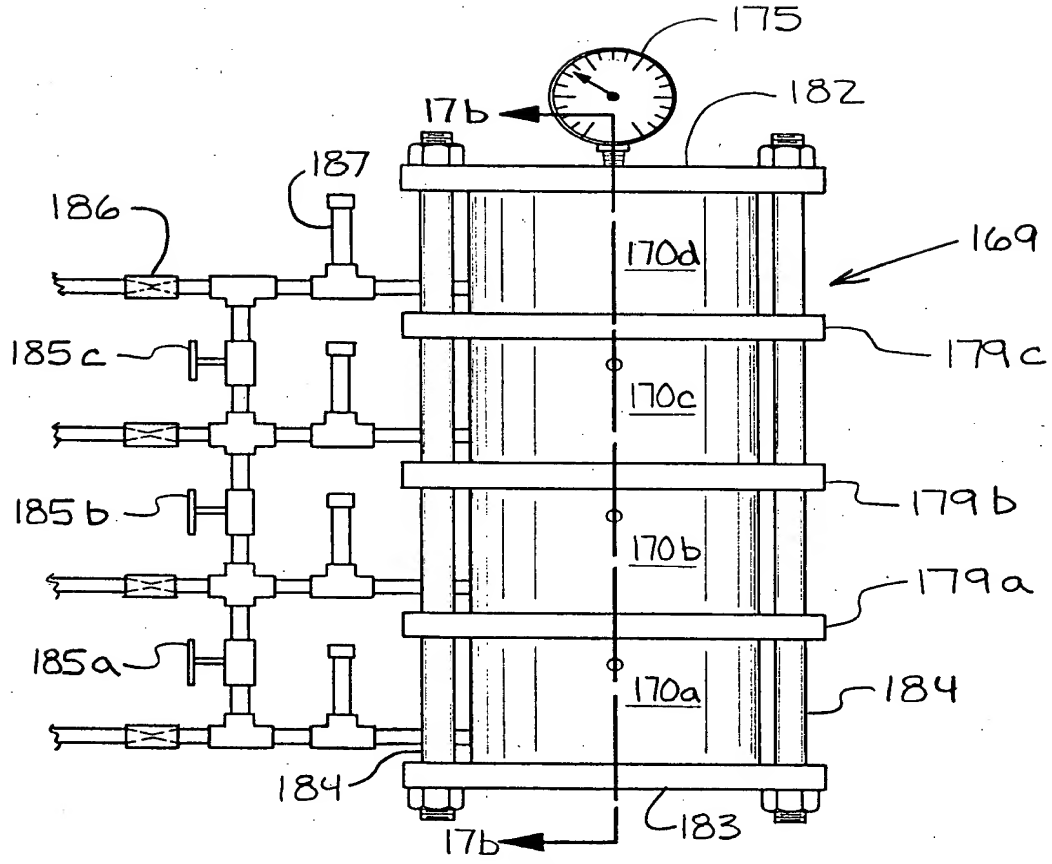


FIG. 17a

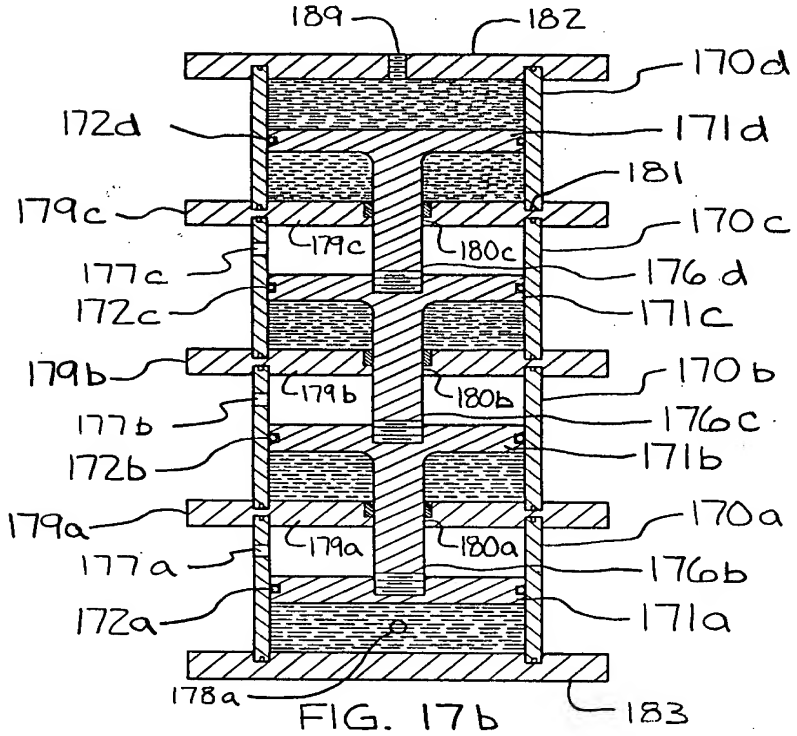


FIG. 17b

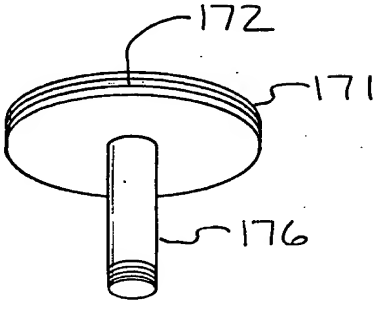


FIG. 17c


ROOM

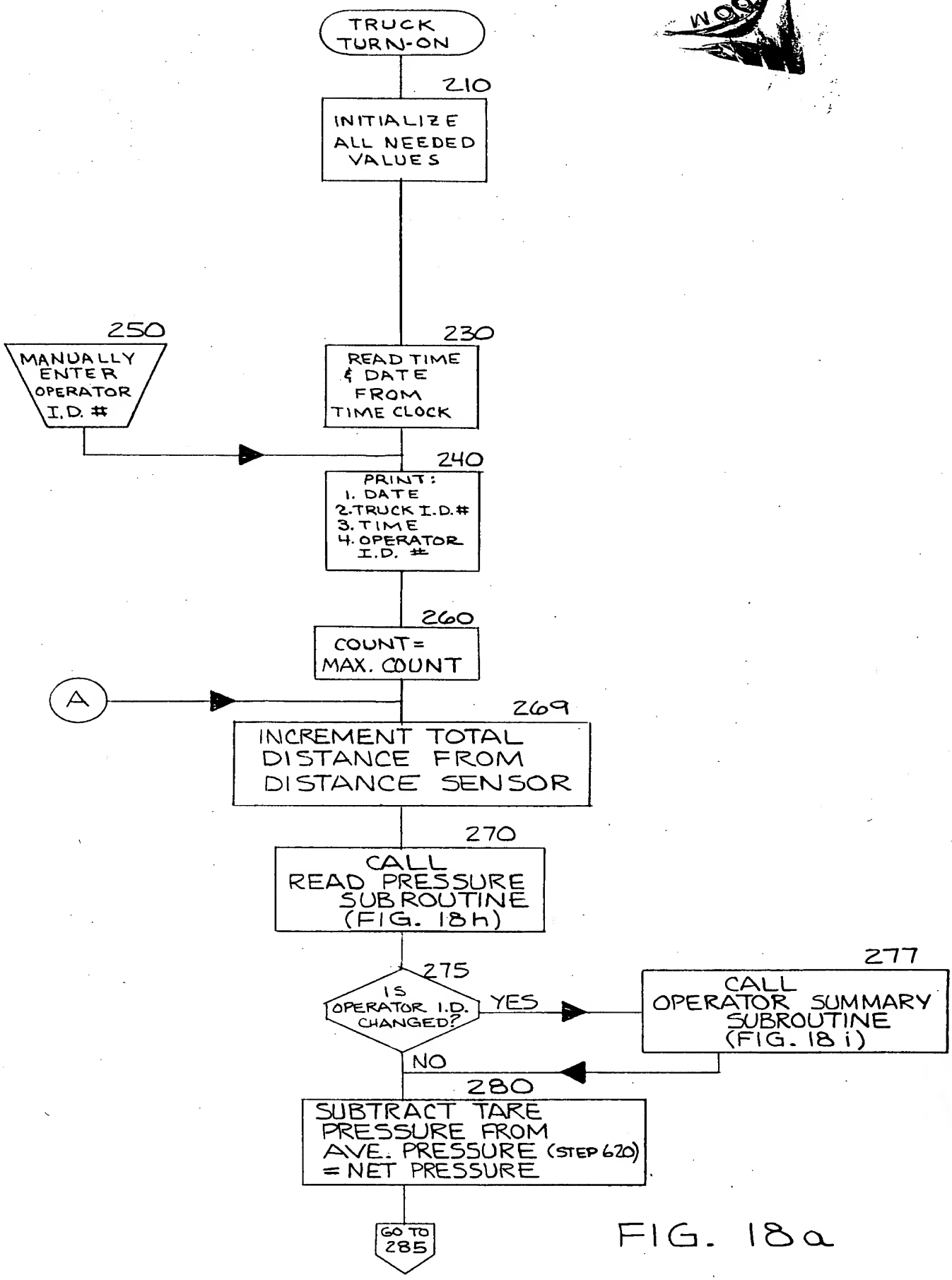

TRUCK TURN-ON
210
INITIALIZE ALL NEEDED VALUES
250
MANUALLY ENTER OPERATOR I.D. #
230
READ TIME & DATE FROM TIME CLOCK
240
PRINT:
1. DATE
2. TRUCK I.D.#
3. TIME
4. OPERATOR I.D. #
260
COUNT= MAX. COUNT
A
269
INCREMENT TOTAL DISTANCE FROM DISTANCE SENSOR
270
CALL READ PRESSURE SUBROUTINE (FIG. 18h)
275
IS OPERATOR I.D. CHANGED?
YES
277
CALL OPERATOR SUMMARY SUBROUTINE (FIG. 18i)
NO
280
SUBTRACT TARE PRESSURE FROM AVE. PRESSURE (STEP 620) = NET PRESSURE
GO TO 285

FIG. 18a

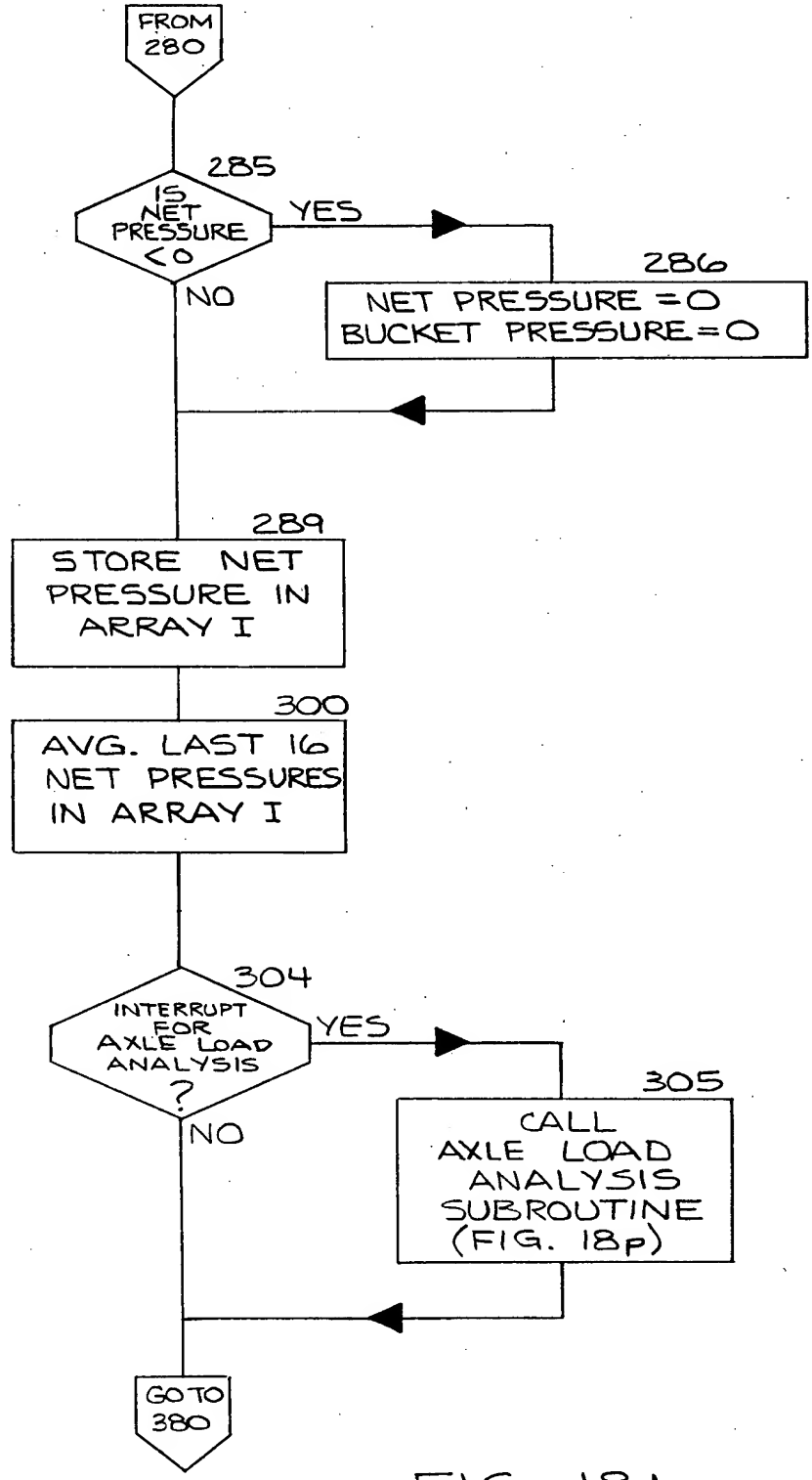

FROM 280
285
IS NET PRESSURE <0
YES
NO
286
NET PRESSURE =0
BUCKET PRESSURE=0
289
STORE NET PRESSURE IN ARRAY I
300
AVG. LAST 16 NET PRESSURES IN ARRAY I
304
INTERRUPT FOR AXLE LOAD ANALYSIS ?
YES
NO
305
CALL AXLE LOAD ANALYSIS SUBROUTINE (FIG. 18p)
GO TO 380

FIG. 18b

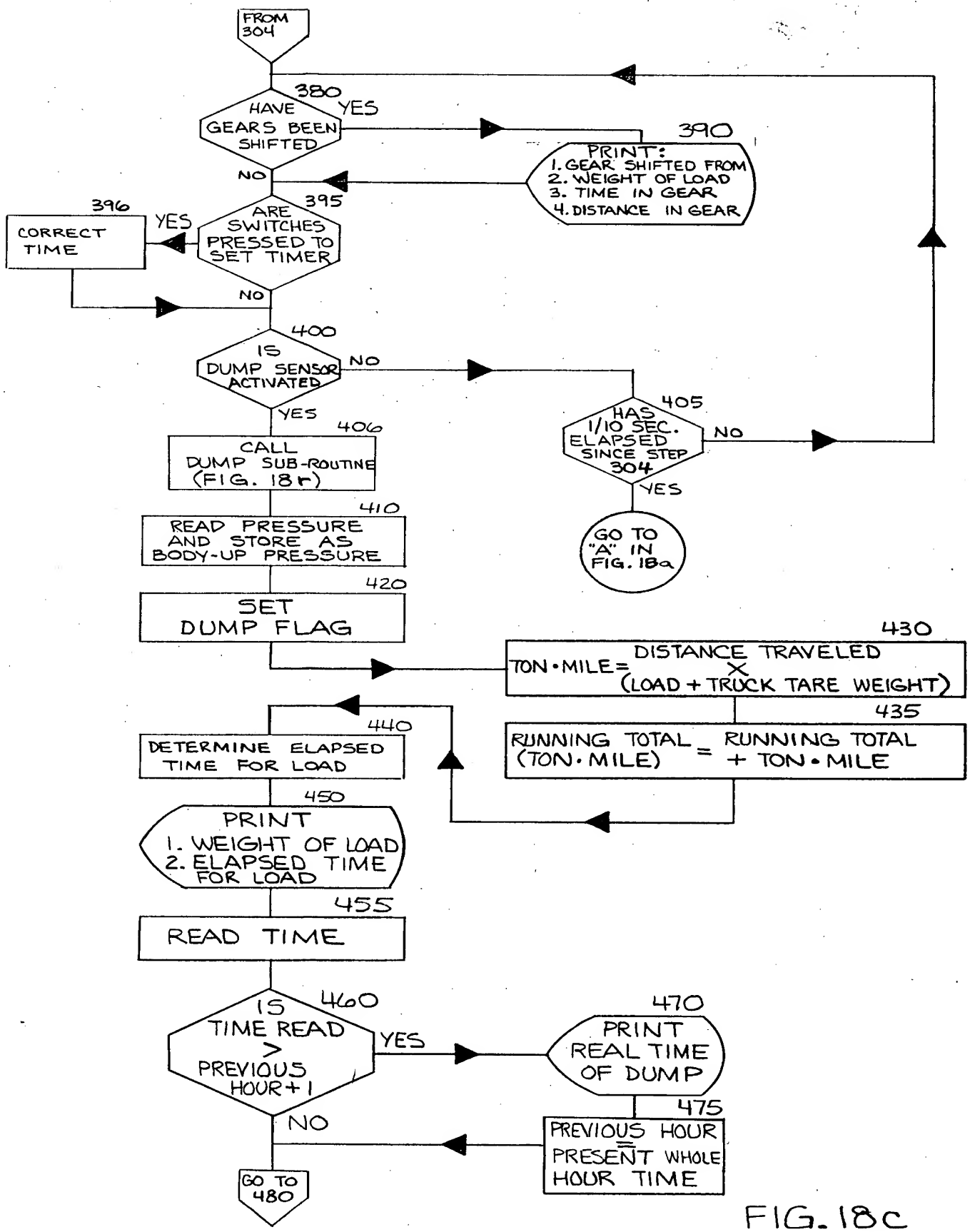

FROM 304
380
HAVE GEARS BEEN SHIFTED
YES
NO
390
PRINT:
1. GEAR SHIFTED FROM
2. WEIGHT OF LOAD
3. TIME IN GEAR
4. DISTANCE IN GEAR
396
CORRECT TIME
YES
395
ARE SWITCHES PRESSED TO SET TIMER
NO
400
IS DUMP SENSOR ACTIVATED
NO
YES
405
HAS 1/10 SEC. ELAPSED SINCE STEP 304
NO
YES
GO TO "A" IN FIG. 18a
406
CALL DUMP SUB-ROUTINE (FIG. 18r)
410
READ PRESSURE AND STORE AS BODY-UP PRESSURE
420
SET DUMP FLAG
430
TON·MILE = DISTANCE TRAVELED × (LOAD + TRUCK TARE WEIGHT)
435
RUNNING TOTAL (TON·MILE) = RUNNING TOTAL + TON·MILE
440
DETERMINE ELAPSED TIME FOR LOAD
450
PRINT
1. WEIGHT OF LOAD
2. ELAPSED TIME FOR LOAD
455
READ TIME
460
IS TIME READ > PREVIOUS HOUR + 1
YES
NO
470
PRINT REAL TIME OF DUMP
475
PREVIOUS HOUR = PRESENT WHOLE HOUR TIME
GO TO 480

FIG. 18c

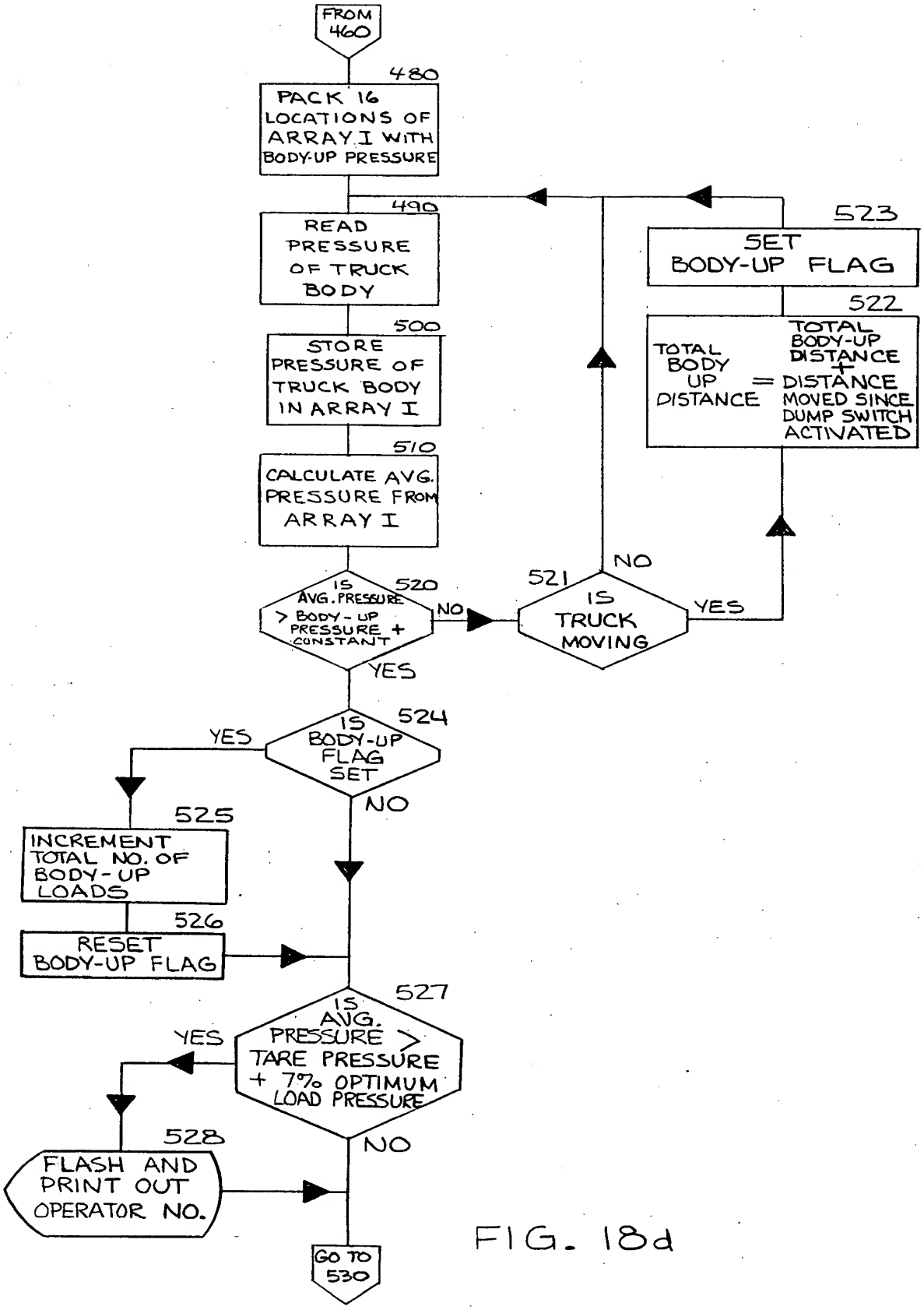

FROM 460
480
PACK 16 LOCATIONS OF ARRAY I WITH BODY-UP PRESSURE
490
READ PRESSURE OF TRUCK BODY
500
STORE PRESSURE OF TRUCK BODY IN ARRAY I
510
CALCULATE AVG. PRESSURE FROM ARRAY I
520
IS AVG. PRESSURE > BODY-UP PRESSURE + CONSTANT
NO
521
IS TRUCK MOVING
NO
YES
523
SET BODY-UP FLAG
522
TOTAL BODY UP DISTANCE = TOTAL BODY-UP DISTANCE + DISTANCE MOVED SINCE DUMP SWITCH ACTIVATED
YES
524
IS BODY-UP FLAG SET
YES
NO
525
INCREMENT TOTAL NO. OF BODY-UP LOADS
526
RESET BODY-UP FLAG
527
IS AVG. PRESSURE > TARE PRESSURE + 7% OPTIMUM LOAD PRESSURE
YES
NO
528
FLASH AND PRINT OUT OPERATOR NO.
GO TO 530

FIG. 18d

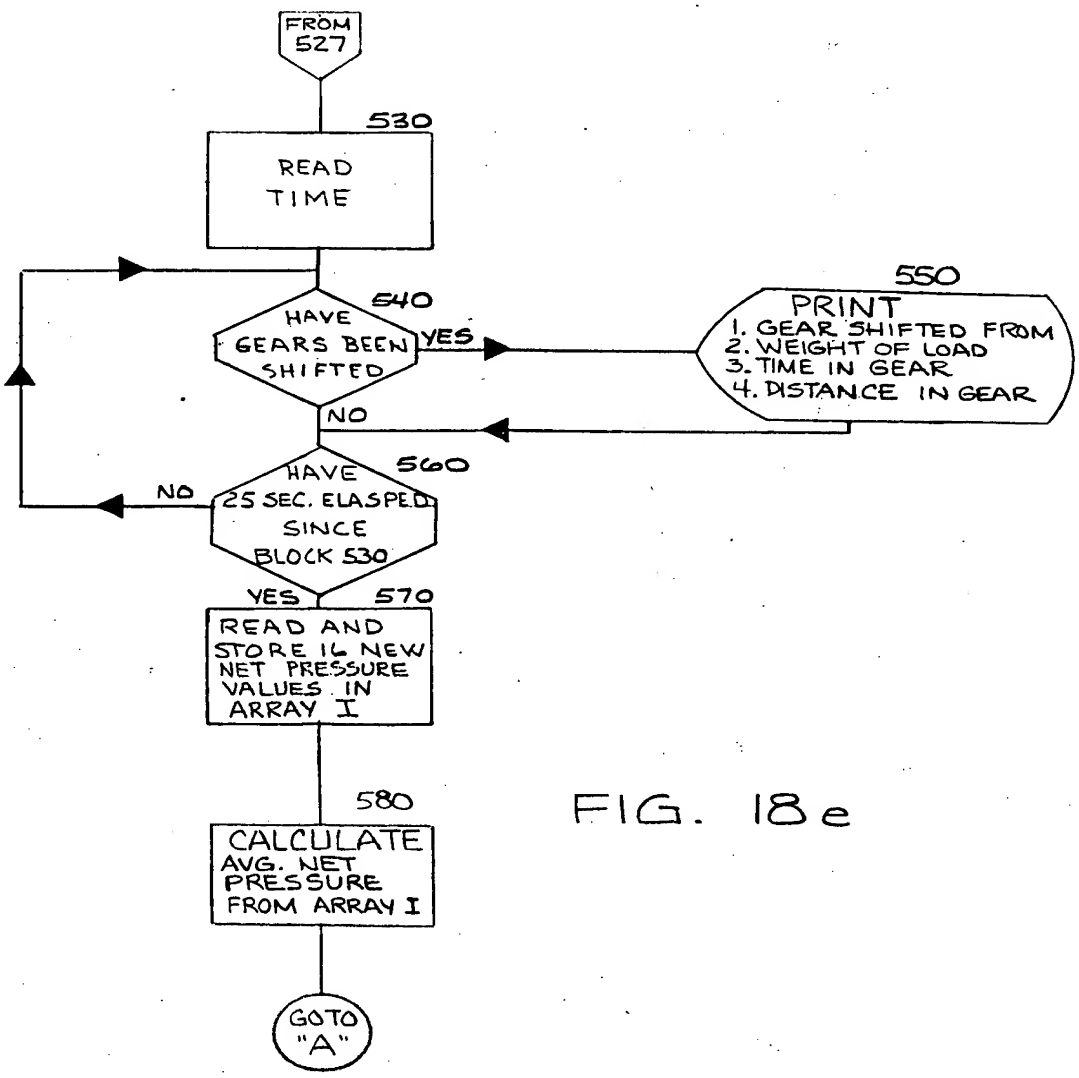

FROM 527
530
READ TIME
540
HAVE GEARS BEEN SHIFTED
YES
550
PRINT
1. GEAR SHIFTED FROM
2. WEIGHT OF LOAD
3. TIME IN GEAR
4. DISTANCE IN GEAR
NO
560
HAVE 25 SEC. ELASPED SINCE BLOCK 530
NO
YES
570
READ AND STORE 16 NEW NET PRESSURE VALUES IN ARRAY I
580
CALCULATE AVG. NET PRESSURE FROM ARRAY I
GOTO "A"

FIG. 18e

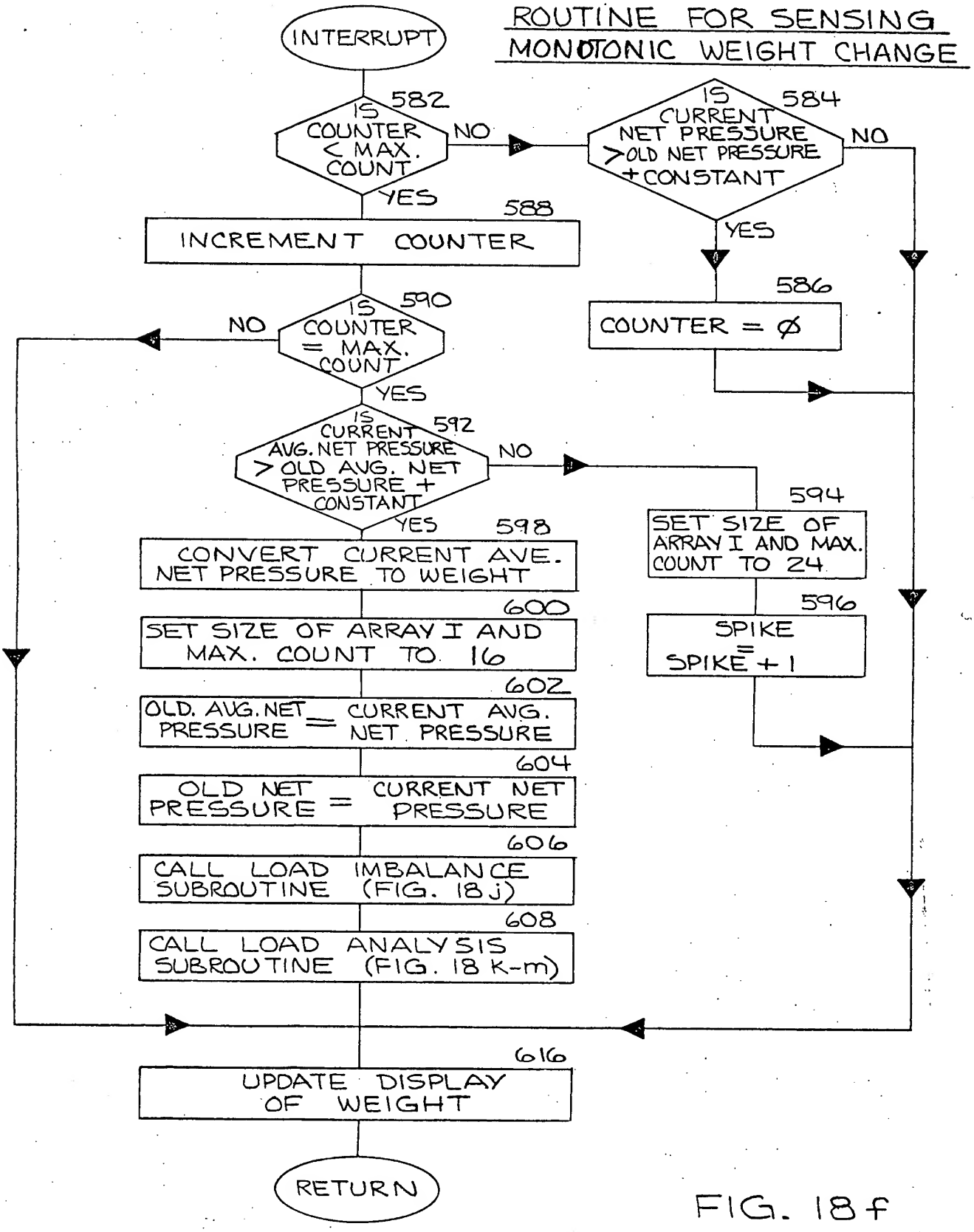

ROUTINE FOR SENSING MONOTONIC WEIGHT CHANGE
INTERRUPT
582
IS COUNTER < MAX. COUNT
NO
YES
584
IS CURRENT NET PRESSURE > OLD NET PRESSURE + CONSTANT
NO
YES
588
INCREMENT COUNTER
586
COUNTER = Ø
590
IS COUNTER = MAX. COUNT
NO
YES
592
IS CURRENT AVG. NET PRESSURE > OLD AVG. NET PRESSURE + CONSTANT
NO
YES
594
SET SIZE OF ARRAY I AND MAX. COUNT TO 24
596
SPIKE = SPIKE + 1
598
CONVERT CURRENT AVE. NET PRESSURE TO WEIGHT
600
SET SIZE OF ARRAY I AND MAX. COUNT TO 16
602
OLD. AVG. NET PRESSURE = CURRENT AVG. NET PRESSURE
604
OLD NET PRESSURE = CURRENT NET PRESSURE
606
CALL LOAD IMBALANCE SUBROUTINE (FIG. 18j)
608
CALL LOAD ANALYSIS SUBROUTINE (FIG. 18 K-m)
616
UPDATE DISPLAY OF WEIGHT
RETURN

FIG. 18f

READ PRESSURE SUBROUTINE

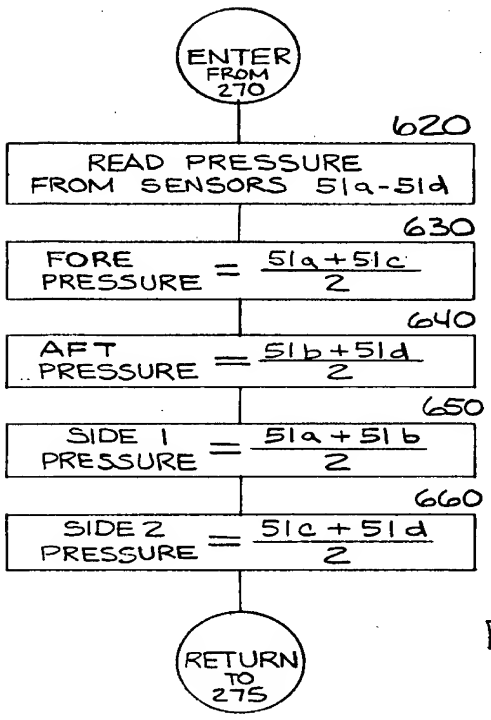


FIG. 18h

OPERATOR NO. CHANGE SUBROUTINE

ENTER FROM 277

669 READ TIME

670 TIME OF NEW OPERATOR TAKING CONTROL = READ TIME

671 TIME UNDER OPERATOR CONTROL = TIME OF NEW OPERATOR TAKING CONTROL − TIME OF OLD OPERATOR TAKING CONTROL

672 TIME OF OLD OPERATOR TAKING CONTROL = TIME OF NEW OPERATOR TAKING CONTROL

673 AVG. WEIGHT OF BUCKET = TOTAL TONNAGE HAULED (STEP 1000) / TOTAL NO. OF BUCKETS (STEP 790)

674 AVG. WEIGHT OF LOAD = TOTAL TONNAGE HAULED (STEP 1000) / TOTAL NO. OF LOADS (STEP 1030)

675 AVG. NO. OF SPIKES PER LOAD = TOTAL NO. OF SPIKES (STEP 1040) / TOTAL NO. OF LOADS (STEP 1030)

676 T·MPH = RUNNING TOTAL (TON·MILE) (STEP 435) / TIME UNDER OPERATOR CONTROL (STEP 671)

677 AVG. HAUL CYCLE TIME = TIME UNDER OPERATOR CONTROL (STEP 671) / TOTAL NO. OF LOADS (STEP 1030)

678 BODY-UP DISTANCE PER BODY-UP LOAD = TOTAL BODY-UP DISTANCE (STEP 522) / TOTAL NO. OF BODY-UP LOADS (STEP 525)

680 AVG. NO. OF BUCKETS PER LOAD = TOTAL NO. OF BUCKETS (STEP 790) / TOTAL NO. OF LOADS (STEP 1030)

690 AVG. TIME BETWEEN BUCKETS = TOTAL ELAPSED LOADING TIME (STEP 850) / TOTAL NO. OF BUCKETS − 1 (STEP 790)

700 AVG. MAX. ELAPSED TIME BETWEEN BUCKETS = TOTAL MAX. ELAPSED TIME BETWEEN BUCKETS (STEP 1020) / TOTAL NO. OF LOADS (STEP 1030)

710 PRINT

1. AVG. WEIGHT OF BUCKET
2. AVG. NO. OF BUCKETS PER LOAD
3. AVG. TIME BETWEEN BUCKETS
4. AVG. MAX ELAPSED TIME BETWEEN BUCKETS
5. AVG. NO. OF SPIKES PER LOAD
6. TOTAL TONNAGE HAULED
7. TOTAL NO. OF LOADS
8. AVG. WEIGHT OF LOAD
9. AVG. HAUL CYCLE TIME
10. TIME UNDER OPERATOR CONTROL
11. REAL TIME OF OPERATOR NO. CHANGE
    a) OLD OPERATOR NO.
    b) NEW OPERATOR NO.
12. BODY-UP DISTANCE PER BODY-UP LOAD
13. TOTAL DISTANCE DRIVEN

RETURN TO 280

FIG. 18i

LOAD IMBALANCE SUBROUTINE

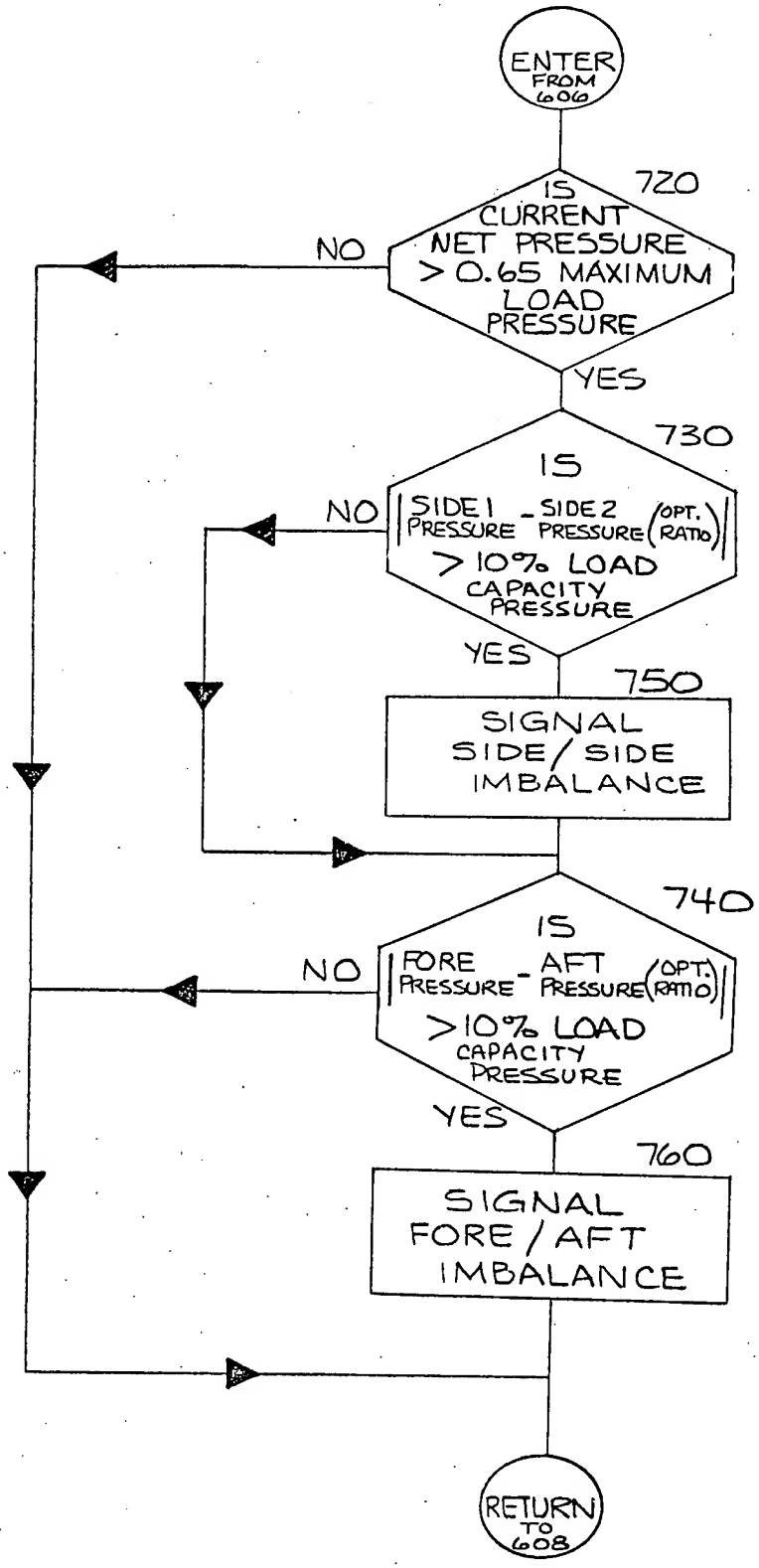


FIG. 18j

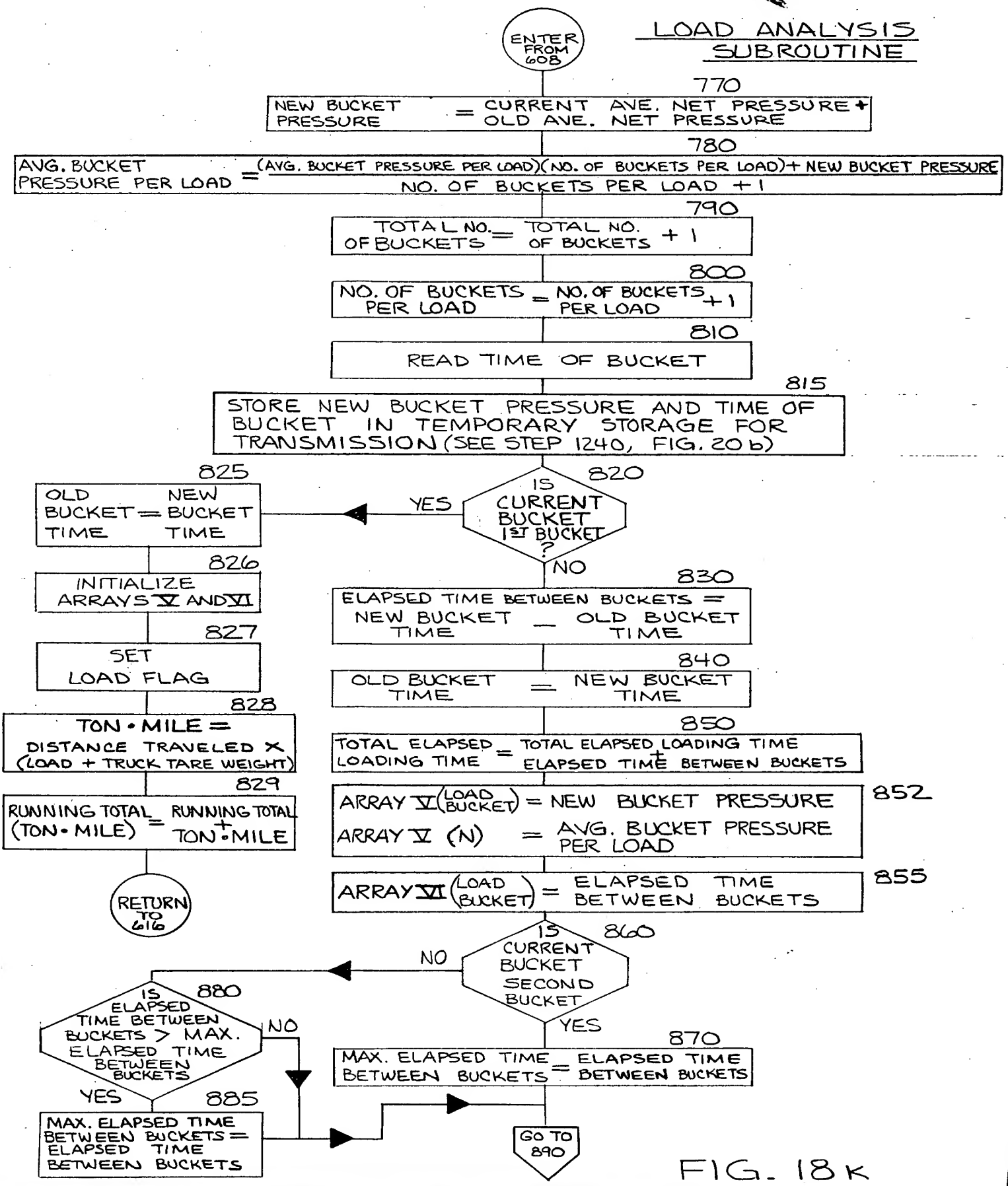

ENTER FROM 608
LOAD ANALYSIS SUBROUTINE
770
NEW BUCKET PRESSURE = CURRENT AVE. NET PRESSURE + OLD AVE. NET PRESSURE
780
AVG. BUCKET PRESSURE PER LOAD = (AVG. BUCKET PRESSURE PER LOAD)(NO. OF BUCKETS PER LOAD) + NEW BUCKET PRESSURE / NO. OF BUCKETS PER LOAD + 1
790
TOTAL NO. OF BUCKETS = TOTAL NO. OF BUCKETS + 1
800
NO. OF BUCKETS PER LOAD = NO. OF BUCKETS PER LOAD + 1
810
READ TIME OF BUCKET
815
STORE NEW BUCKET PRESSURE AND TIME OF BUCKET IN TEMPORARY STORAGE FOR TRANSMISSION (SEE STEP 1240, FIG. 20b)
820
IS CURRENT BUCKET 1ST BUCKET ?
YES
825
OLD BUCKET TIME = NEW BUCKET TIME
826
INITIALIZE ARRAYS V AND VI
827
SET LOAD FLAG
828
TON • MILE = DISTANCE TRAVELED X (LOAD + TRUCK TARE WEIGHT)
829
RUNNING TOTAL (TON • MILE) = RUNNING TOTAL TON • MILE
RETURN TO 616
NO
830
ELAPSED TIME BETWEEN BUCKETS = NEW BUCKET TIME − OLD BUCKET TIME
840
OLD BUCKET TIME = NEW BUCKET TIME
850
TOTAL ELAPSED LOADING TIME = TOTAL ELAPSED LOADING TIME + ELAPSED TIME BETWEEN BUCKETS
852
ARRAY V (LOAD BUCKET) = NEW BUCKET PRESSURE
ARRAY V (N) = AVG. BUCKET PRESSURE PER LOAD
855
ARRAY VI (LOAD BUCKET) = ELAPSED TIME BETWEEN BUCKETS
860
IS CURRENT BUCKET SECOND BUCKET
NO
YES
870
MAX. ELAPSED TIME BETWEEN BUCKETS = ELAPSED TIME BETWEEN BUCKETS
880
IS ELAPSED TIME BETWEEN BUCKETS > MAX. ELAPSED TIME BETWEEN BUCKETS
NO
YES
885
MAX. ELAPSED TIME BETWEEN BUCKETS = ELAPSED TIME BETWEEN BUCKETS
GO TO 890

FIG. 18K

LOAD ANALYSIS SUBROUTINE (CONT.)

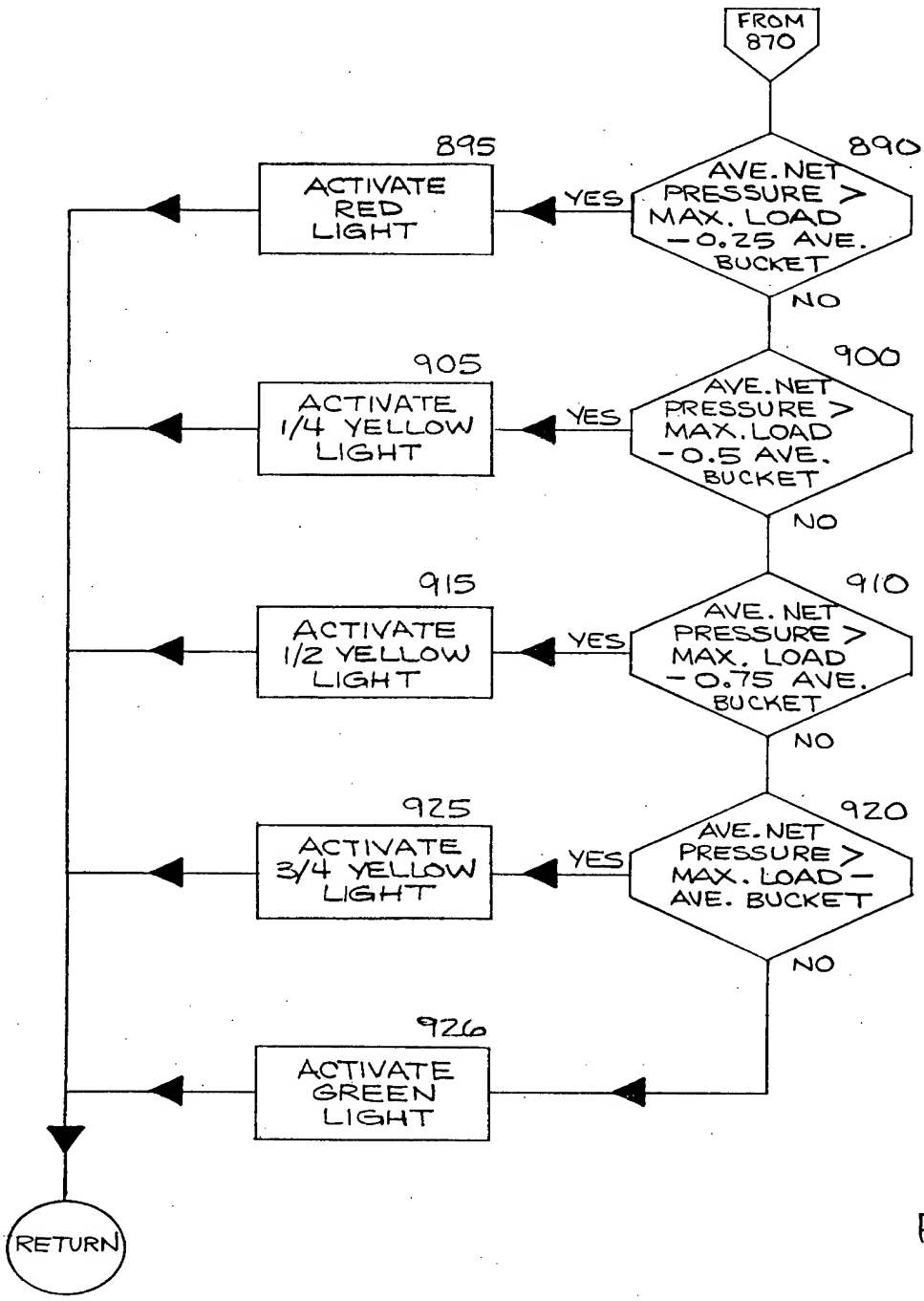


FIG. 18m

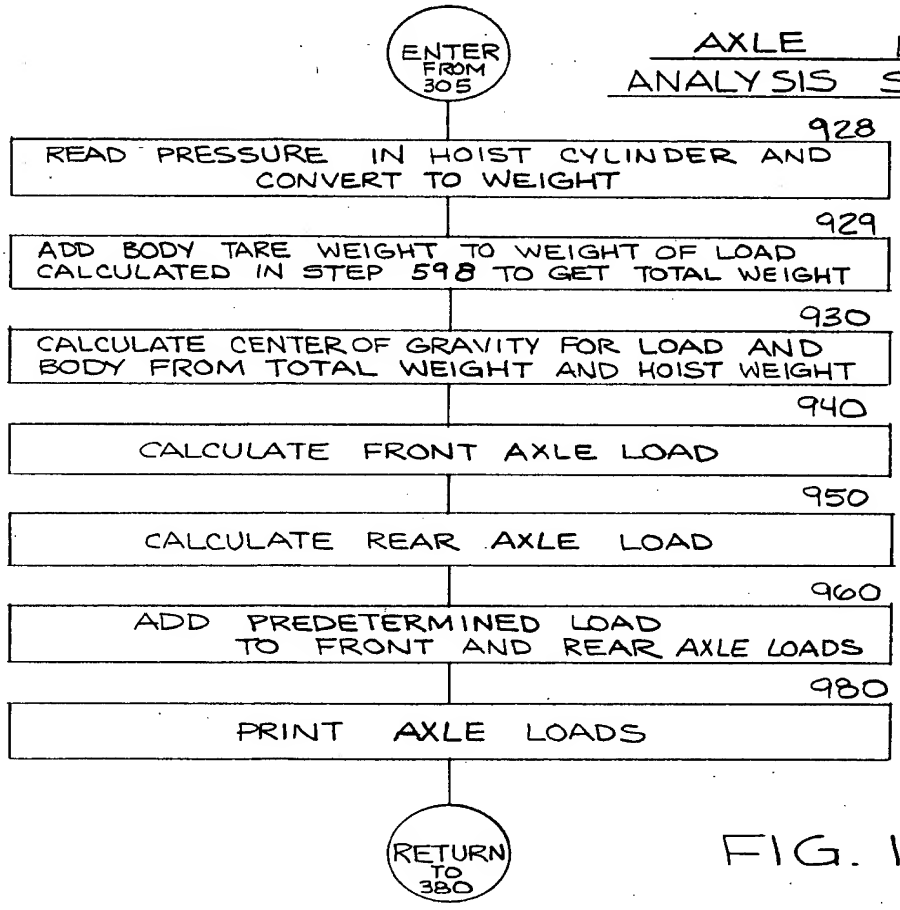

ENTER FROM 305
AXLE LOAD ANALYSIS SUBROUTINE
928
READ PRESSURE IN HOIST CYLINDER AND CONVERT TO WEIGHT
929
ADD BODY TARE WEIGHT TO WEIGHT OF LOAD CALCULATED IN STEP 598 TO GET TOTAL WEIGHT
930
CALCULATE CENTER OF GRAVITY FOR LOAD AND BODY FROM TOTAL WEIGHT AND HOIST WEIGHT
940
CALCULATE FRONT AXLE LOAD
950
CALCULATE REAR AXLE LOAD
960
ADD PREDETERMINED LOAD TO FRONT AND REAR AXLE LOADS
980
PRINT AXLE LOADS
RETURN TO 380

FIG. 18P

DUMP SUBROUTINE

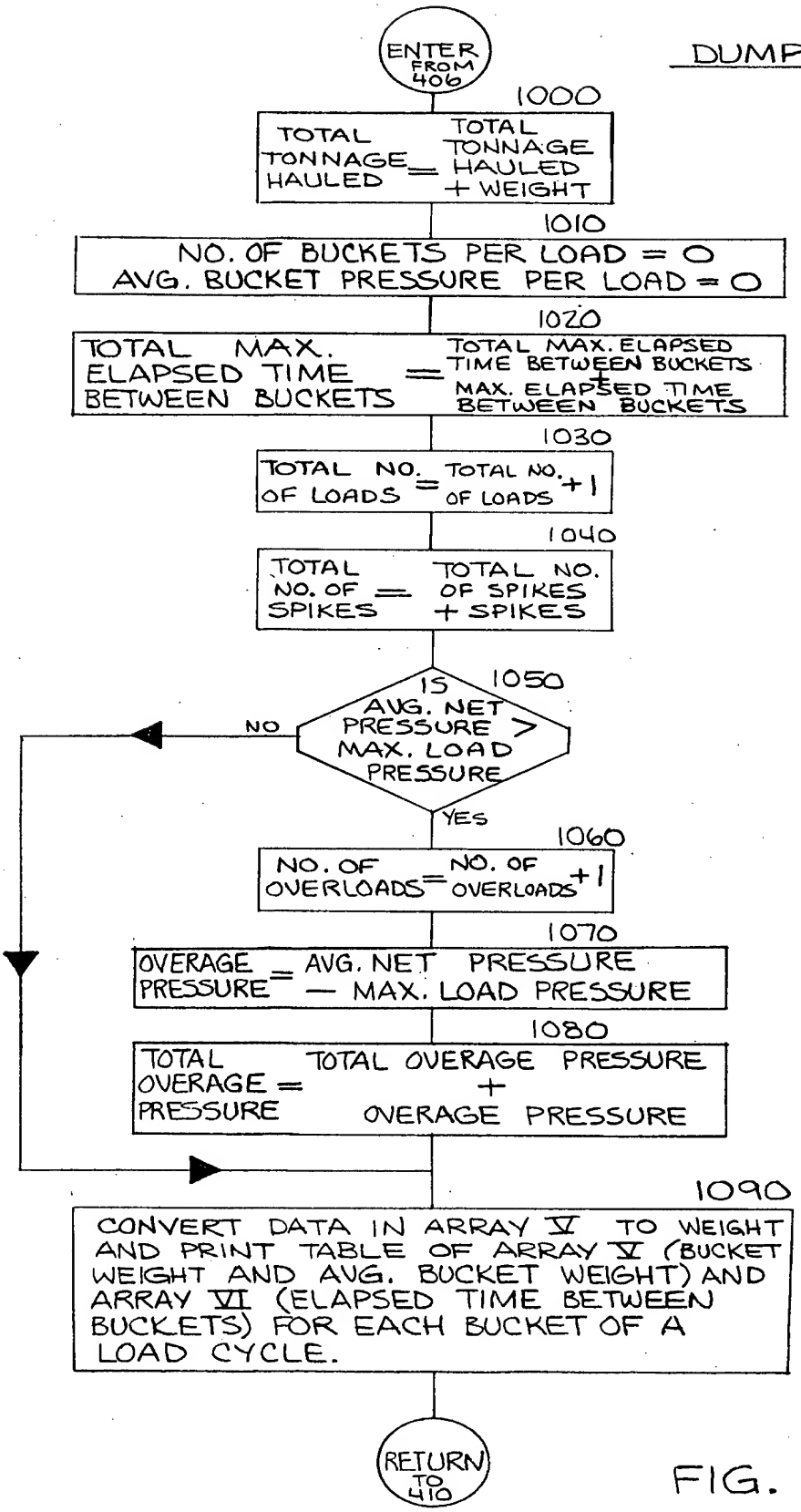


FIG. 18r

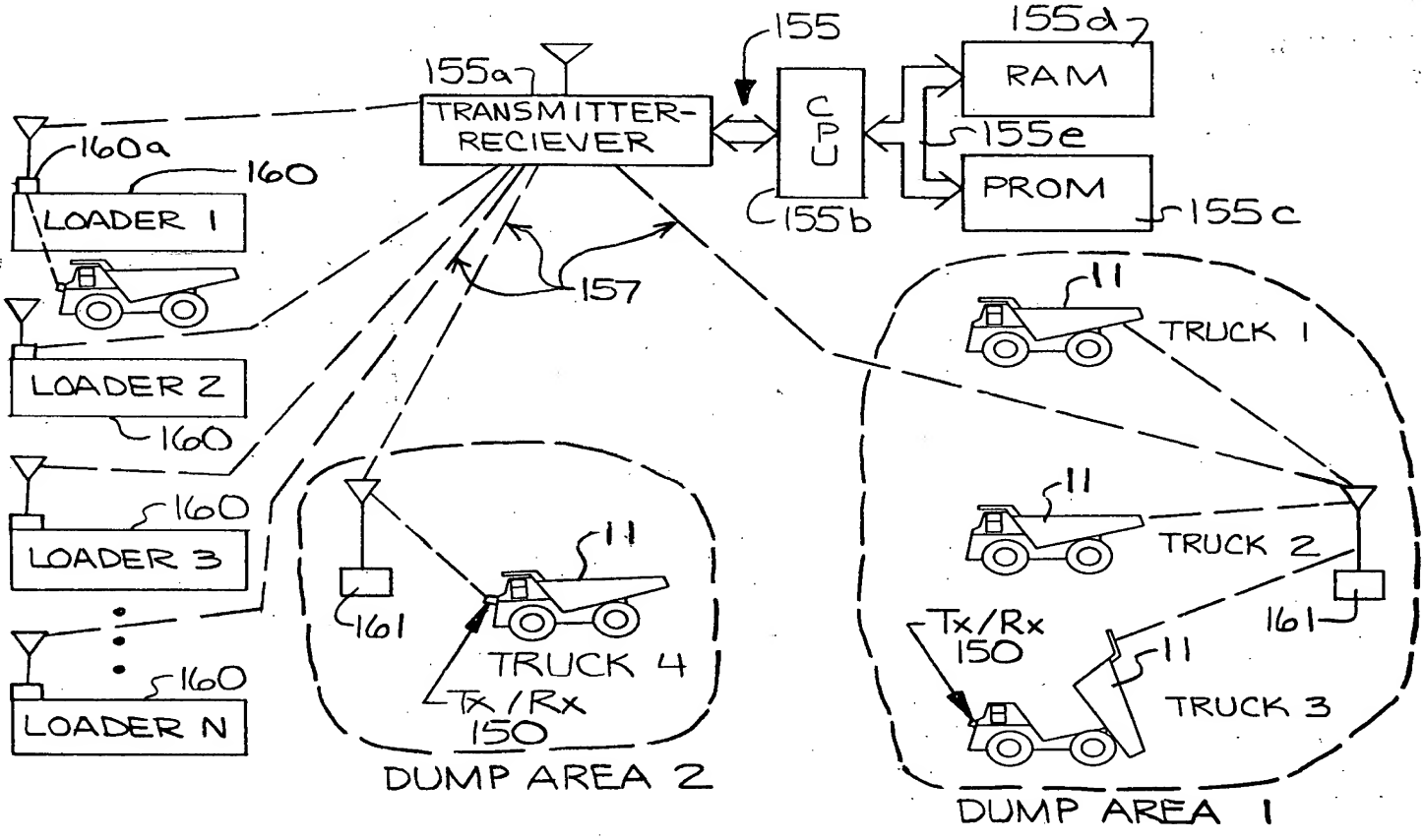


FIG. 19a

SYNC	TRUCK NO.	DUMP OR LOAD
SYNC	TRUCK NO.	LOADER NO.

FIG. 19b

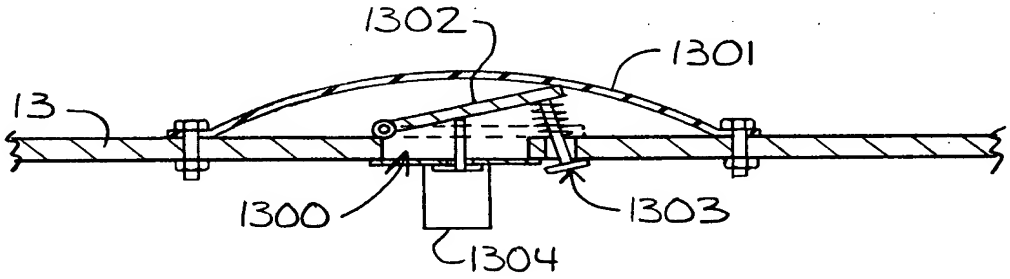


FIG. 19c

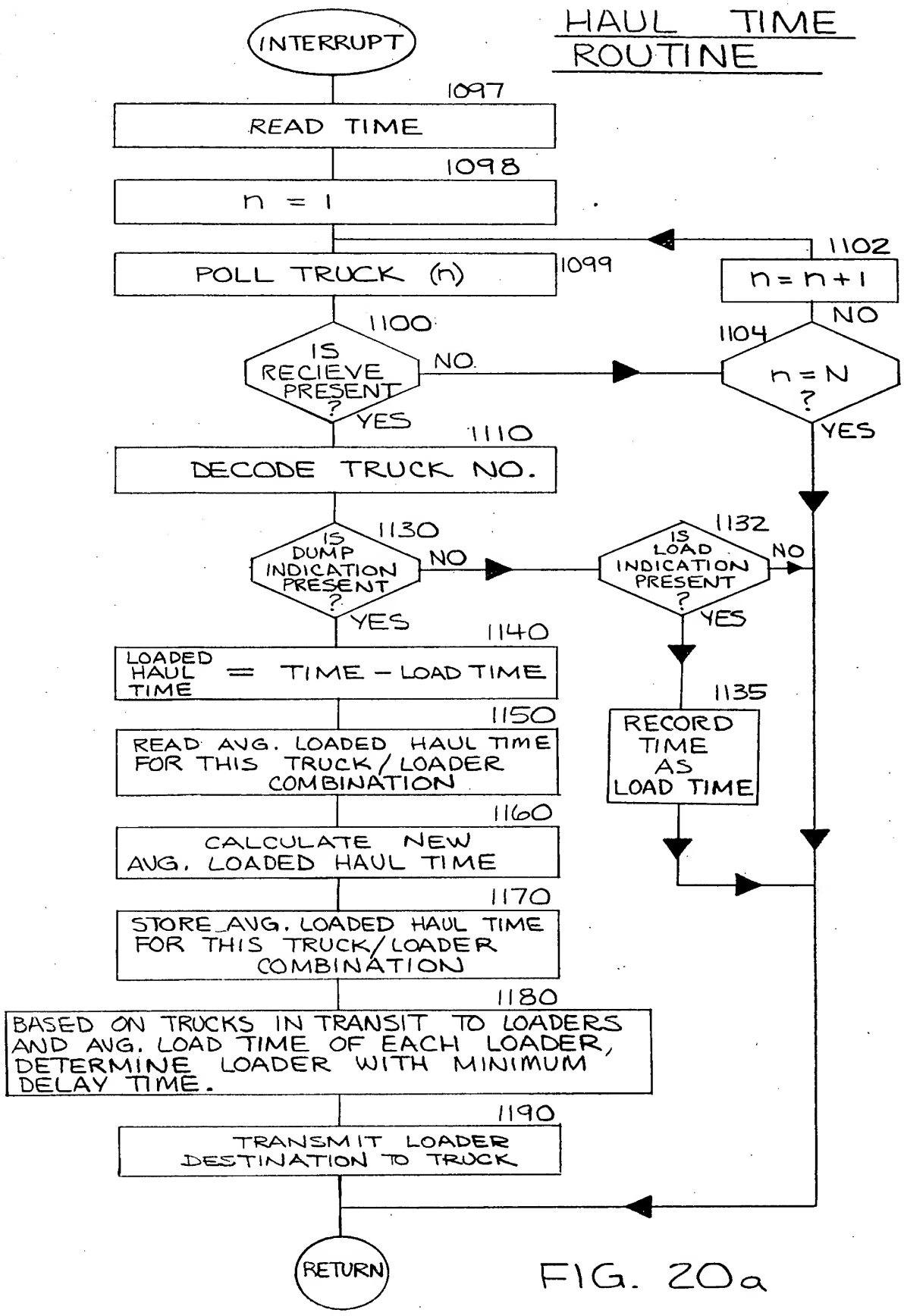

HAUL TIME ROUTINE
INTERRUPT
1097
READ TIME
1098
n = 1
1099
POLL TRUCK (n)
1100
IS RECIEVE PRESENT ?
NO
YES
1102
n = n+1
NO
1104
n = N ?
YES
1110
DECODE TRUCK NO.
1130
IS DUMP INDICATION PRESENT ?
NO
YES
1132
IS LOAD INDICATION PRESENT ?
NO
YES
1135
RECORD TIME AS LOAD TIME
1140
LOADED HAUL TIME = TIME - LOAD TIME
1150
READ AVG. LOADED HAUL TIME FOR THIS TRUCK/LOADER COMBINATION
1160
CALCULATE NEW AVG. LOADED HAUL TIME
1170
STORE AVG. LOADED HAUL TIME FOR THIS TRUCK/LOADER COMBINATION
1180
BASED ON TRUCKS IN TRANSIT TO LOADERS AND AVG. LOAD TIME OF EACH LOADER, DETERMINE LOADER WITH MINIMUM DELAY TIME.
1190
TRANSMIT LOADER DESTINATION TO TRUCK
RETURN

FIG. 20a

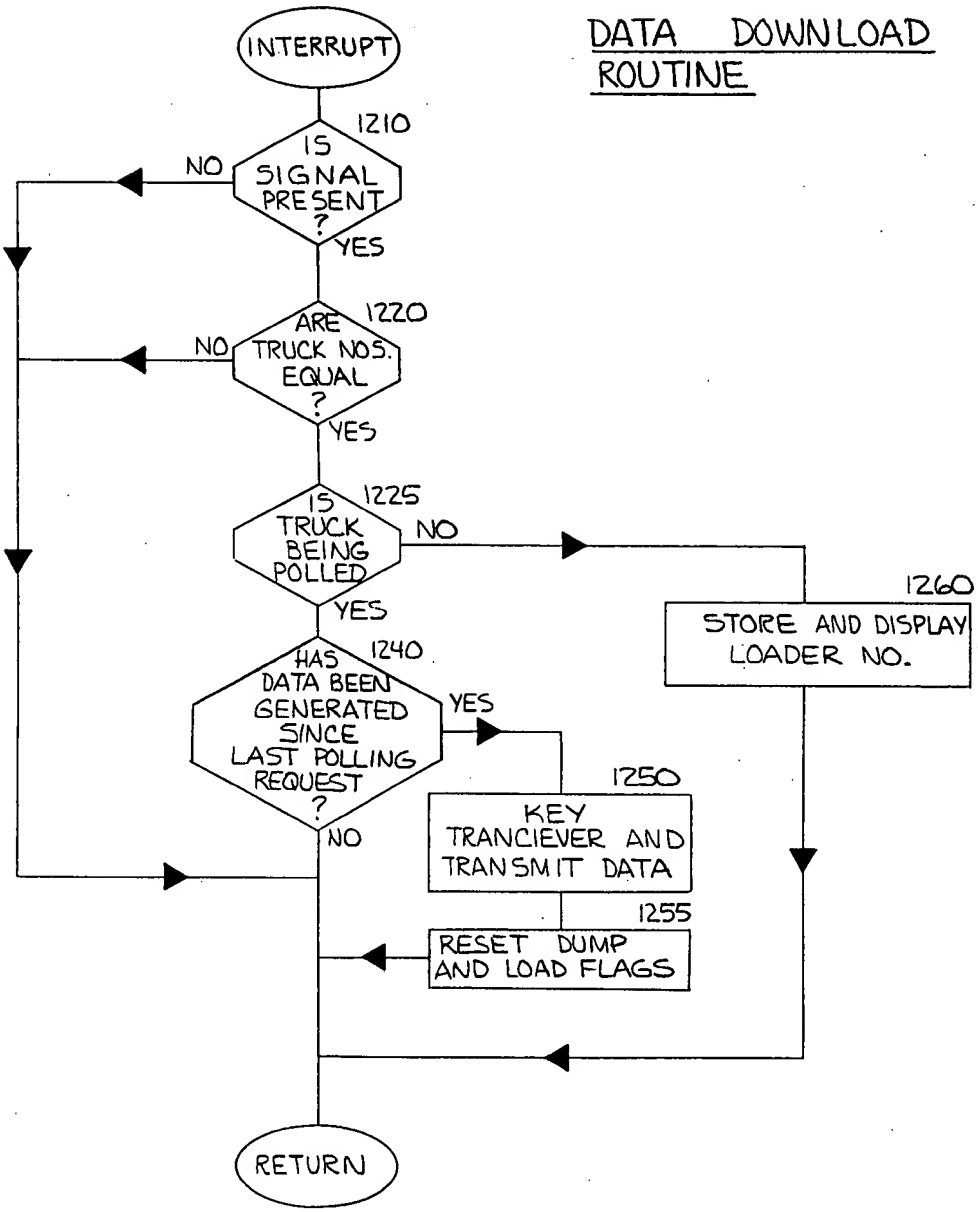

DATA DOWNLOAD ROUTINE
INTERRUPT
1210
IS SIGNAL PRESENT ?
NO
YES
1220
ARE TRUCK NOS. EQUAL ?
NO
YES
1225
IS TRUCK BEING POLLED
NO
YES
1260
STORE AND DISPLAY LOADER NO.
1240
HAS DATA BEEN GENERATED SINCE LAST POLLING REQUEST ?
YES
NO
1250
KEY TRANCIEVER AND TRANSMIT DATA
1255
RESET DUMP AND LOAD FLAGS
RETURN

FIG. 20b